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# BUSINESS OPPORTUNITIES IN SPACE

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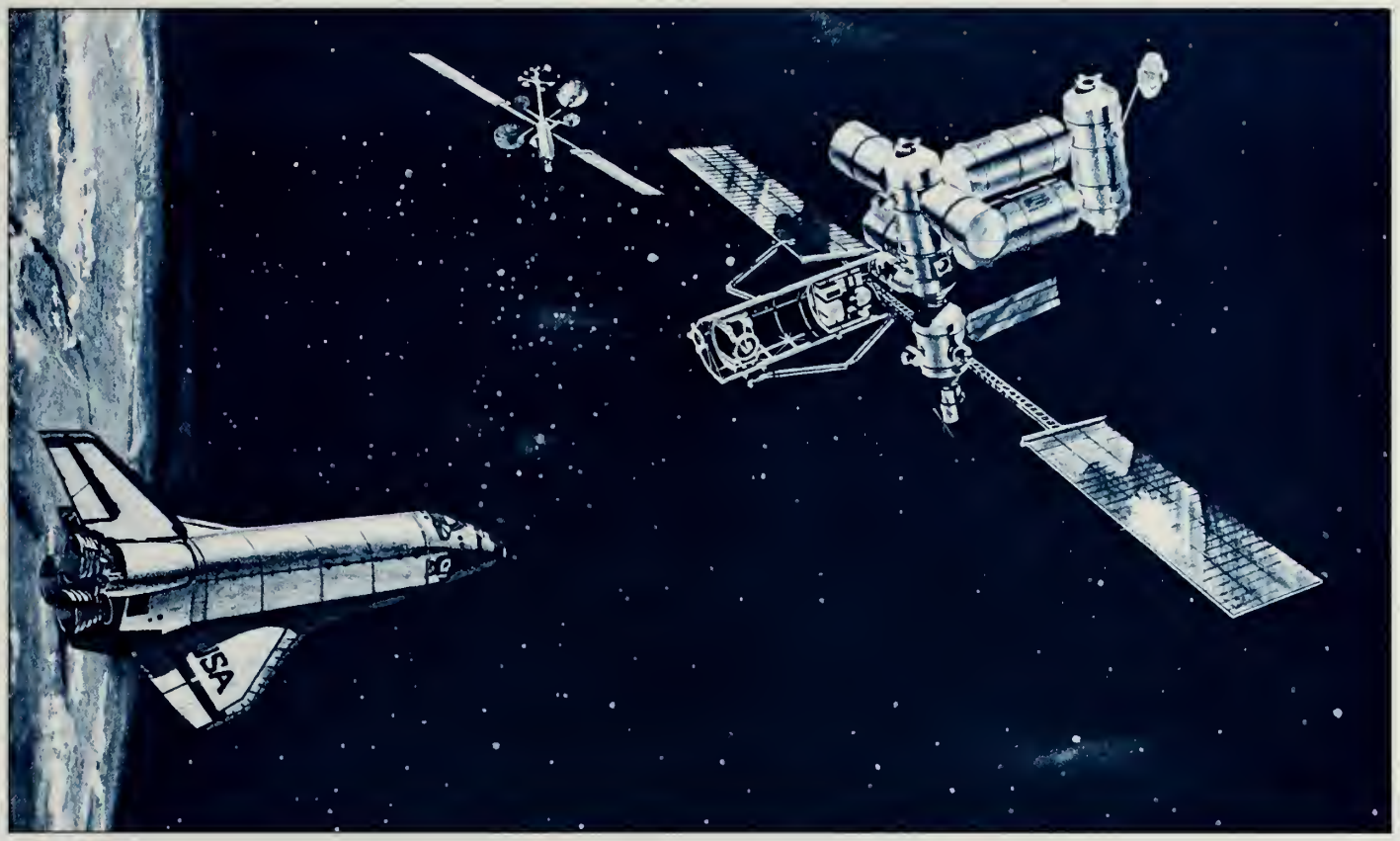


The Center for Space Policy, Inc.

The Commonwealth of Massachusetts
Executive Office of Economic Affairs

## BUSINESS OPPORTUNITIES IN SPACE

The launch of the Space Shuttle Columbia in March of 1981 began a far-reaching revolution. The Space Shuttle program is the result of a quarter century of work devoted to developing our knowledge of the space environment and our ability to utilize it. We are now ready to move beyond exploration to exploitation of "the new ocean."

**This conference is aimed at developing a pragmatic understanding of the issues involved in the commercial exploitation of space.** Much has been written over recent months concerning emerging opportunities for industrial research and manufacturing in space. However, much of what has been discussed has taken place on the level of technological capability, as opposed to commercial viability. The Center for Space Policy, Inc./The Commonwealth of Massachusetts sponsored conference is intended to bring together selected speakers from industry, federal and state government, and the financial community.

## WHO SHOULD ATTEND

- Members of the financial community: commercial banks, investment banks, brokers, security analysts, venture capitalists.
- Executives in high technology fields from both aerospace and non-aerospace corporations and telecommunication industries.
- Entrepreneurs in emerging high technologies fields from business and academia.
- Lawyers and accountants with expertise in aerospace, non-aerospace, and telecommunications.
- Massachusetts state representatives and senators.

MASS. MAI.2: B96

The Center for Space Policy, Inc.

1972 Massachusetts Avenue • Cambridge, MA 02140

# CONFERENCE AGENDA

## BUSINESS OPPORTUNITIES IN SPACE

November 16, 1984

Royal Sonesta Hotel
Cambridge, Massachusetts

## CONFERENCE AGENDA

| | | |
|---|---|---|
| 8:30 AM | *Conference Registration* | |
| 9:00 | *Opening Remarks* | David W. Lippy, President,<br>The Center for Space Policy, Inc. |
| 9:15 | *Keynote Address* | National Policies<br>on the Commercial Use of Space:<br>New Business Opportunities<br>Bud Evans, Director,<br>NASA Commercialization Task Force |
| 10:00 | *Coffee Break* | |
| 10:30 | | NASA Initiatives: Commercializaion<br>and the Outreach Program<br>Pat Templeton,<br>NASA Associate Administrator<br>For External Relations |
| 11:15 | | The Space Station Program: Commercial Opportunities<br>John Hodge,<br>Associate Administrator of NASA's Office<br>Of Space Station |
| 12:00 PM | *Luncheon* | |
| 1:00 | *Luncheon Address* | Massachusetts & Space:<br>From Apollo to Space Station<br>The Honorable Evelyn Murphy,<br>Secretary of Economic Affairs,<br>The Commonwealth of Massachusetts |
| 2:00 | | Opportunities in Space:<br>• Hardware/Software<br>• Emergency Commercial Technologies<br>• National Security Space Technologies<br>Brad M. Meslin, Executive Vice President,<br>The Center for Space Policy, Inc. |
| 2:45 | *Coffee Break* | |
| 3:15 | | Cost Justification for the Introduction<br>of New Technologies<br>Carl A. Prussing, Director,<br>Management Consulting Services, Main Hurdman |
| 4:00 | | Financing Options:<br>James P. Samuels, First Vice President<br>Shearson Lehman/American Express |
| 4:45 | *Closing Remarks* | David W. Lippy, President<br>The Center for Space Policy, Inc. |
| 5:00 | *Cocktail Reception* | |

The Center for Space Policy, Inc.

September 1, 1984

name
title
company/university
address

Dear Mr. Smith:

In January 1984 President Reagan announced that the United States would develop and launch a permanently manned space station "within a decade." Congress funded the advanced definition phase of the $8-10 billion, 10-year program at $150 million for FY 1985. On July 20, 1984, the President announced a U.S. National Policy for the Commercial Use of Space, which will provide tax and regulatory incentives to companies that invest in commercial space ventures. Finally, during the past year, the Administration's Strategic Defense Initiative (SDI) program has gained support in the Congress and carries with it a projected R&D budget of nearly $25 billion through FY 1989.

These and other federal space programs will present significant new opportunities for Massachusetts high-tech firms to profit by acting as contractors, subcontractors, or by investing in commercial space ventures on their own.

In order to explore emerging opportunities in space, The Center for Space Policy, Inc., and the Commonwealth of Massachusetts are pleased to invite you to a conference entitled BUSINESS OPPORTUNITIES IN SPACE. The conference, to be held on Friday, November 16, 1984 at the Royal Sonesta Hotel in Cambridge, will help the Massachusetts business and academic communities to take advantage of the new space business environment.

Enclosed, please find the details of the conference. I look forward to meeting you on November 16 to address ways that government, academia and the private sector in Massachusetts can work together to participate fully in a new range of space activities.

Sincerely,

David W. Lippy
President
The Center for Space Policy, Inc.

encl

1972 Massachusetts Avenue, Cambridge, MA 02140 • Telephone: (617) 576-2828

EVELYN F. MURPHY

"BUSINESS OPPORTUNITIES IN SPACE"

CAMBRIDGE ROYAL SONESTA

NOVEMBER 16, 1984

THANK YOU DAVID.

ON BEHALF OF GOVERNOR MICHAEL DUKAKIS, LET ME TELL YOU HOW PLEASED MASSACHUSETTS IS TO HOST THIS CONFERENCE ON "BUSINESS OPPORTUNITIES IN SPACE."

I AM EXCITED AND ENCOURAGED BY THE FACT THAT NASA'S AGENDA FOR EXPLORING THE BUSINESS POTENTIAL OF OUTER SPACE SHARES SO MUCH IN COMMON WITH THE DUKAKIS ADMINISTRATION'S EFFORTS TO FOSTER THE GROWTH AND DEVELOPMENT OF THE NEXT GENERATION OF HIGH TECHNOLOGIES IN MASSACHUSETTS.

IT'S CLEAR TO ME THAT NASA AND THE STATE OF MASSACHUSETTS HAVE MUCH TO OFFER TO ONE ANOTHER AND THE TIMING COULDN'T BE BETTER.

WHAT I'D LIKE TO DO THEREFORE, IS TAKE THIS OPPORTUNITY TO TALK ABOUT BUSINESS OPPORTUNITIES IN SPACE WITHIN THE CONTEXT OF THE DUKAKIS ADMINISTRATION'S PROGRAM CALLED "CENTERS OF EXCELLENCE."

FIRST A BIT OF HISTORY.

MASSACHUSETTS IS SOMEWHAT OF AN ECONOMIC PARADOX. ALTHOUGH WE WERE NOT BLESSED WITH AN ABUNDANCE OF NATURAL RESOURCES, WE HAVE NONETHELESS LED THE COUNTRY THROUGH TWO TECHNOLOGICAL "REVOLUTIONS."

THE FIRST WAS IN THE NINETEENTH CENTURY. BACK THEN THE MASSACHUSETTS TEXTILE INDUSTRY, TOGETHER WITH THE MACHINE AND SUPPORTING MACHINE TOOL INDUSTRIES HELPED LAUNCH THE U.S. INDUSTRIAL REVOLUTION.

AND IN THE 1950s AND 60's THE MANY ELECTRONICS COMPANIES THAT "SPUN OFF" FROM HARVARD TO M.I.T. TO CREATE THE FAMOUS "TECHNOLOGY HIGHWAY" ALONG ROUTE 128, WAS KEY TO FUELING THE CURRENT HIGH TECH BOOM.

THE LOCATION OF THOSE NINETEENTH CENTURY TEXTILE MILLS WERE DETERMINED PRIMARILY BY THE AVAILABILITY OF RUNNING WATER.

ON THE OTHER HAND, THE HIGH TECH COMPANIES THAT SPRUNG UP AFTER WORLD WAR II WERE THE HARBINGERS OF THE INFORMATION AGE: LESS DEPENDENT ON NATURAL

RESOURCES MORE RELIANT ON KNOWLEDGE.

CONSEQUENTLY THESE COMPANIES TENDED TO LOCATE CLOSE TO THE SOURCES OF THEIR MOST CRITICAL INPUT: INFORMATION. THAT'S WHY WE FIND THEM CLUSTERED AROUND OUR OUTSTANDING COLLEGES AND UNIVERSITIES.

TODAY IT'S CLEAR THAT WE ARE IN THE MIDST OF A TRANSITION TO A KNOWLEDGE-BASED ECONOMY. BY CONCENTRATING ON NEW DESIGNS AND APPLICATIONS OF NEW MATERIALS, SCIENTISTS AND ENGINEERS HAVE SUCCEEDED IN MAKING AUTOMOBILES AND HOUSES MORE ENERGY EFFICIENT, PLASTICS MORE DURABLE AND COMPUTERS MORE POWERFUL.

WHAT'S MADE THIS POSSIBLE IS THE FACT THAT OUR COLLEGES AND UNIVERSITIES ARE PLAYING A MORE ACTIVE ROLE IN THE PROCESS OF ECONOMIC DEVELOPMENT THAN EVER BEFORE.

THIS IMPORTANT FACT HAS NOT BEEN OVERLOOKED BY THE DUKAKIS ADMINISTRATION. NOR BY NASA, WHICH HAS CHARACTERISTICALLY CONTRACTED OUT MUCH OF ITS R&D TO COLLEGES AND UNIVERSITIES AROUND THE COUNTRY. HERE IN MASSACHUSETTS, THE DUKAKIS ADMINISTRATION IS CONVINCED THAT THE KEY TO CONTINUED ECONOMIC SUCCESS IS LINKED THE CREATION OF MORE FORMAL PARTNERSHIPS BETWEEN BUSINESS AND ACADEMIC.

THAT'S WHY THE GOVERNOR, WORKING THROUGH MY OFFICE OF ECONOMIC AFFAIRS HAS INITIATED A RATHER AMBITIOUS PROGRAM CALLED "CENTERS OF EXCELLENCE". THESE CENTERS ARE DESIGNED TO IMPROVE OUR COMPETITIVE POSTURE WITH OTHER STATES AND COUNTRIES IN BIOTECHNOLOGY, POLYMER SCIENCE, PHOTOVOLTAICS AND MARINE SCIENCE. WE PLAN TO ACCOMPLISH THIS BY STRENGTHENING THE TIES BETWEEN INDUSTRY, EDUCATION AND GOVERNMENT. EACH IS

DEVELOPED AROUND A SPECIFIC EMERGING TECHNOLOGY AND INSTITUTIONS OF ACADEMIC EXCELLENCE.

THEY REPRESENT A FIRM COMMITMENT ON OUR PART TO INVEST IN THE FUTURE.

AS I MENTIONED EARLIER THEIR ARE A NUMBER OF AREAS WHERE OUR EFFORTS AND NASA'S CONVERGE. LET ME GIVE YOU SOME EXAMPLES.

OUR POLYMER CENTER OF EXCELLENCE IS LOCATED IN WESTERN MASSACHUSETTS AROUND THE UNIVERSITY OF MASSACHUSETTS IN AMHERST.

UMASS HAS ONE OF THE LARGEST AND ONE OF THE BEST POLYMER PROGRAMS IN THE COUNTRY.

POLYMERS DOMINATE TODAY'S MATERIALS INDUSTRY AND PLAY A KEY ROLE IN DOZENS OF OTHER INDUSTRIES RANGING FROM AGRICULTURE AND FOOD PROCESSING TO AUTOMOBILES, MEDICINE AND ENERGY.

THERE IS ENORMOUS POTENTIAL FOR NEW HIGH PERFORMANCE MATERIALS BASED ON POLYMERS TO REPLACE GLASS AND METALS IN A NUMBER OF APPLICATIONS.

IT'S CONCEIVABLE THAT POLYMER SCIENTISTS AT AMHERST COULD ASSIST IN THE DEVELOPMENT OF MATERIALS THAT COULD FURTHER REDUCE THE WEIGHT OF MANY OF THE SPACE STATION COMPONENTS AND THEREBY HELP CUT BACK ON THE AMOUNT OF PAYLOAD THAT HAS TO BE LIFTED INTO ORBIT. I INVITE YOU TO VISIT THE AMHERST CAMPUS AND SEE FOR YOURSELVES THE OUSTANDING WORK GOING ON THERE.

WHO KNOWS. PERHAPS SOMETIME IN THE FORESEEABLE FUTURE RESEARCHERS IN AMHERST MAY WANT TO EXPERIMENT WITH SYNTHESIZING BIOPOLYMERS IN THE GRAVITY-FREE ENVIRONMENT OF SPACE..

THE UNIVERSITY OF MASSACHUSETTS IS NOW SEEKING TO ESTABLISH A NEW CENTER FOR POLYMER SCIENCE ON ITS CAMPUS. THE DUKAKIS ADMINISTRATION AND THE LEGISLATURE ARE SUPPORTING THIS EFFORT AND HAVE AUTHORIZED $6M IN THE FY'84 CAPITAL OUTLAY BUDGET FOR THIS PURPOSE.

IN A RELATED EFFFORT. SENATOR CHET ATKINS HAS INTRODUCED LEGISLATION TO ESTABLISH THE MASSACHUSETTS ADVANCED MATERIALS CHARACTERIZATION AND APPLICATIONS CENTER.

THIS PROPOSED CENTER WILL BE INVOLVED IN SIX AREAS OF NEW MATERIALS RESEARCH:

- HIGH PERFORMANCE CERAMICS
- SYNTHETIC MEMBRANES FOR NEW SEPARATION TECHNOLOGY
- SYNTHETIC METALS (ELECTRICITY CONDUCTING POLYMERS)
- HIGH PERFORMANCE PLASTICS
- ADVANCED ALLOYS AND CONTROLLED CRYSTALLINE STRUCTURES

AND

- ADVANCED COMPOSITE MATERIALS

ONCE ESTABLISHED, THIS CENTER WOULD MAKE MASSACHUSETTS HOME TO THE ONLY STATE-INITIATED RESEARCH CENTER IN THE U.S. DEDICATED TO

UNDERSTANDING THE FUNDAMENTAL SCIENCE OF MATERIALS. AN AREA OF GREAT INTEREST TO NASA.

IN CENTRAL MASSACHUSETTS WE ARE WORKING WITH THE DEVELOPMENT ARM OF THE WORCESTER CHAMBER OF COMMERCE - THE WORCESTER BUSINESS DEVELOMPENT CORPORATION - TO BUILD A BIOTECHNOLOGY PARK ADJACENT TO THE UMASS MEDICAL SCHOOL.

UMASS MED IS ONE OF FIVE LOCAL INSTITUTIONS FOR HIGHER LEARNING THAT HAVE JOINED TOGETHER TO FORM THE MASSACHUSETTS BIOTECHNOLOGY RESEARCH INSTITUTE (MBRI).

BY POOLING THE RESOURCES OF THESE INSTITUTIONS MBRI HOPES TO HELP ATTRACT BIOMEDICAL AND BIOTECH COMPANIES INTO WORCESTER.

AN INTEGRAL PART OF THE BIOTECH PARK WILL BE AN INNOVATION CENTER WITH A TOTALLY-EQUIPPED CONFERENCE FACILITY; A BIOTECHNOLOGY INFORMATION CLEARINGHOUSE AND LIBRARY; AN INCUBATION CENTER FOR SMALL, GROWING BUSINESSES; A TECHNOLOGY CENTER TO ENCOURAGE THE DEVELOPMENT OF INSTRUMENTATION; FLEXIBLE OFFICE AND LABORATORY FACILITIES; AND A FERMENTATION SCALE-UP FACILITY TO SERVE PARK TENANTS ON A LEASED TIME-SHARING BASIS.

THROUGH MY OFFICE THE DUKAKIS ADMINISTRATION AWARDED A $50,000 PLANNING GRANT TO THE WORCESTER BUSINESS DEVELOPMENT CORPORATION TO HELP WITH THE INITIAL PHASE OF THIS PROJECT.

WE ARE PROVIDING ADDITIONAL SUPPORT IN THE FORM OF A CONSULTANT WHO IS HELPING TO DEVELOP A MARKETING PLAN FOR THE PARK.

BIOTECHNOLOGY IS ANOTHER AREA THAT STANDS TO BENEFIT FROM THE SPACE STATION PROGRAM.

A RECENT ARTICLE IN THE NEW YORK TIMES REPORTS THAT MCDONNELL DOUGLAS AND ORTHO PHARMACEUTICAL, A DIVISION OF JOHNSON AND JOHNSON, ARE PARTNERS IN A JOINT VENTURE TO PRODUCE A WIDE RANGE OF PHARMACEUTICAL PRODUCTS IN SPACE.

THIS PAST SUMMER, AN ENGINEER FROM MCDONNELL BECAME THE FIRST PERSON REPRESENTING PRIVATE INDUSTRY TO VENTURE INTO SPACE.

WE WON'T REST EASY UNTIL WE LAUNCH OUR FIRST MASSACHUSETTS INDUSTRY REP INTO ORBIT.

IN ALL SERIOUSNESS, THE BIOTECH INDUSTRY IS AT A CRITICAL POINT IN ITS SHORT HISTORY. INVESTORS ARE

IMPATIENTLY WAITING FOR THE BREAKTHROUGHS THAT WILL RESULT IN MARKETABLE PRODUCTS AND PROFITS.

IT COULD VERY WELL BE THAT THE ENVIRONMENT OF SPACE MIGHT BE A MAJOR CONTRIBUTING FACTOR IN FACILITATING SOME OF THOSE BREAKTHROUGHS IN THE VERY NEAR FUTURE.

BEFORE I CONTINUE WITH MORE EXAMPLES OF POSSIBLE COLLABORATIONS BETWEEN THE CENTERS OF EXCELLENCE AND NASA SPACE COMMERCIALIZATION EFFORTS, I WANT TO SAY SOMETHING ABOUT THE SYNERGY THAT OUR CENTERS ARE GENERATING.

AN IMPORTANT CHARACTERISTIC OF THE EMERGING KNOWLEDGE-BASED ECONOMY BESIDES ITS SHIFT IN EMPHASIS FROM DEPENDENCY ON LARGE INPUTS OF ENERGY AND RAW

MATERIALS TO INPUTS OF INFORMATION. IS ITS INTERDISCIPLINARY NATURE.

THE WALLS THAT HAVE TRADITIONALLY ISOLATED ONE ACADEMIC DISCIPLINE FROM ANOTHER ARE BEGINNING TO BE DISMANTLED. AS A RESULT, WE HAVE SEEN SOME VERY EXCITING AND UNEXPECTED INNOVATIONS. FOR EXAMPLE:

- GENETIC ENGINEERS ARE WORKING WITH POLYMER SCIENTISTS IN THE SEARCH FOR TECHNIQUES FOR ENHANCING THE PRODUCTION OF BIOPOLYMERS - NATURAL POLYMERS PRODUCED BY LIVING ORGANISMS, AND ARE THEREFORE BIODEGRADABLE.

AND

- POLYMER SCIENTISTS WORKING WITH SCIENTISTS IN THE MICROELECTRONICS FIELD WHO HAVE SUCCESSFULLY

PRODUCED ELECTRICITY CONDUCTING PLASTICS OR SYNTHETIC METALS

AND

- TEAMS COMPOSED OF BIOTECHNOLOGISTS COMPUTER SCIENTISTS AND ENGINEERS WHO ARE CONTEMPLATING THE FEASIBILITY OF BUILDING BIOCHIP COMPUTERS. BASED ON CARBON RATHER THAN SILICON.

THESE ARE NEW PRODUCTS THAT WILL OPEN UP NEW MARKETS THAT FEW. IF ANY. EVEN THOUGHT WERE POSSIBLE A FEW YEARS AGO.

THE CENTERS OF EXCELLENCE PROGRAM AND NASA'S CIVILIAN SPACE PROGRAM BOTH PROVIDE THE KIND OF OVER-ARCHING "UMBRELLA" THAT ENCOURAGES CROSS-FERTILIZATION AND THE RESULTING SYNERGY.

NOW LET ME COMPLETE MY WALK-THROUGH OF CENTERS OF EXCELLENCE.

IN THE NORTHEASTERN PART OF THE STATE WE ARE FOSTERING THE DEVELOPMENT AND GROWTH OF OUR PHOTOVOLTAIC INDUSTRY. AS MOST OF YOU KNOW PHOTOVOLTAICS ARE SOLID STATE DEVICES WHICH CONVERT SUNLIGHT DIRECTLY INTO ELECTRICITY.

OF COURSE THE SPACE PROGRAM IS NO STRANGER TO PHOTOVOLTAICS. SINCE THEY ARE MOST ECONOMICAL AS ELECTRICITY PRODUCERS IN REMOTE AREAS, FAR FROM A POWER GRID. THE ENVIRONMENT OF OUTER SPACE IS A NATURAL FOR PHOTOVOLTAICS. IN FACT, THE SPACE PROGRAM IS WHERE THIS TECHNOLOGY FOUND ITS FIRST PRACTICAL APPLICATION.

AS PHOTOVOLTAICS ARE STILL THE MOST APROPRIATE MEANS FOR GENERATING POWER IN SPACE. WE'D LIKE TO MAKE SURE THAT NASA OFFICIALS ARE AWARE THAT MASSACHUSETTS IS HOME TO SOME OF THE FINEST PRODUCERS OF CELLS AND BALANCE OF SYSTEMS.

FOR OUR PART, THE DUKAKIS ADMINISTRATION IS HELPING THE MASS PV INDUSTRY PENETRATE THEIR OTHER MAJOR MARKET - THE THIRD WORLD COUNTRIES.

DEVELOPING COUNTRIES WHERE POPULATIONS ARE WIDELY DISPERSED AND THE PEOPLE ARE POOR AND IN NEED OF ELECTRICITY FOR SUCH THINGS AS IRRIGATION, LIGHTING AND REFRIGERATION ARE AREAS WHERE PHOTOVOLTAICS MAKE SENSE ECONOMICALLY.

THE EXISTENCE OF A VAST MARKET FOR PHOTOVOLTAIC SYSTEMS AND RENEWABLE ENERGY TECHNOLOGIES HAS BEEN DOCUMENTED BY BOTH MARKETING ANALYSTS IN THE PRIVATE AND PUBLIC SECTORS. WITHIN 34 YEARS, PHOTOVOLTAICS ARE EXPECTED TO PROVIDE 25% OF THE WORLD ENERGY SUPPLY. IT SHOULD ALSO BE NOTED THAT MASSACHUSETTS ENJOYS 51 PERCENT OF THE U.S. MARKET AND 28% OF THE WORLD MARKET. HOWEVER, OUR PV COMPANIES DO NOT ALWAYS HAVE THE RESOURCES TO IMPLEMENT THEIR OWN EFFECTIVE MARKETING STRATEGIES.

U.S. SECRETARY OF ENERGY DONALD HODEL HAS INVITED MASSACHUSETTS TO PRESENT A REGIONAL MARKETING PROGRAM FOR A PHOTOVOLTAICS AND RENEWABLE ENERGY EXPORT PROGRAM. THE MEETING WILL TAKE PLACE IN DECEMBER.

SECRETARY HODEL HAS ALSO PERSONALLY INVITED HIS FELLOW CABINET SECRETARIES FROM COMMERCE, ARGICULTURE AND STATE, AND THE HEADS OF THE EXPORT-IMPORT BANK AND THE AGENCY FOR INTERNATIONAL DEVELOPMENT TO REVIEW THE MASSACHUSETTS PROPOSAL.

THIS PROGRAM IS BEING JOINTLY ADMINISTERED BY THE EXECUTIVE OFFICE OF ENERGY RESOURCES AND ECONOMIC AFFAIRS. OTHER PARTICIPATING INSTITUTIONS INCLUDE: MIT, PEDDOCKS ISLAND TRUST, MDC, AND MASSACHUSETTS PHOTOVOLTAICS COMPANIES.

AS PART OF THIS CONTINUING EFFORT TO FORM PARTNERSHIPS BETWEEN GOVERNMENT AND THE PRIVATE SECTOR IN ADVANCING EMERGING TECHNOLOGIES IN MASSACHUSETTS, THE STATE STREET TRADE DEVELOPMENT COMPANY AND MERIDIAN CORPORATION HAVE BEEN DESIGNED

TO CONDUCT A STUDY ON THE MASSACHUSETTS PHOTOVOLTAICS EXPORTING MARKET.

BOTH STATE STREET AND MERIDIAN CORPORATION HAVE EXTENSIVE EXPERIENCE IN OVERSEAS MARKETING AND TRADE. COMBINED WITH A KNOWLEDGE OF THE PHOTOVOLTAIC INDUSTRY. ITS EXPORT PROBLEMS AND AVAILABLE FEDERAL AND STATE GOVERNMENT ASSISTANCE PROGRAMS.

THE 3-MONTH STUDY BEGAN IN MID-OCTOBER.

IN THE SOUTHEASTERN PART OF THE STATE WE ARE CONCENTRATING ON THE DEVELOPMENT OF THE MARINE SCIENCES.

WE ARE CURRENTLY WORKING WITH THE GOVERNOR'S OFFICE ON SEVERAL INITIATIVES WHICH WILL ENHANCE THE GROWTH

OF A STRONG MARINE ACADEMIC AND INDUSTRIAL BASE ALONG OUR COAST.

OUR MAJOR PROJECT IN THIS AREA TO DATE INVOLVES OUR EFFORTS TO ESTABLISH A FEDERALLY FUNDED NORTHEAST REGIONAL OCEAN SERVICE CENTER IN MASSACHUSETTS.

THESE CENTERS ARE DESIGNED TO IMPROVE DELIVERY OF SERVICES AND PRODUCTS OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) - THE ONE FEDERAL AGENCY CHARGED SPECIFICALLY WITH ANALYZING AND PREDICTING OCEANIC AND ATMOSPHERIC COMPONENTS OF THE EARTH'S ENVIRONMENT.

WE HAVE MET WITH MEMBERS OF THE NOAA STAFF AND ARE AGGRESSIVELY PURSUING THIS.

WE HAVE A WEALTH OF EDUCATIONAL AND RESEARCH INSTITUTIONS TO WORK WITH ON OUR MARINE-RELATED INITIATIVES INCLUDING: THE WOODS HOLE OCEANOGRAPHIC INSTITUTE, THE MARINE BIOLOGICAL LABORATORY, SOUTHEASTERN MASSACHUSETTS UNIVERSITY AND THE MASSACHUSETTS MARITIME ACADEMY.

WE ARE WORKING WITH THREE OF THESE: WHOI, SMU, AND MASS MARITIME TO CREATE TO JOINT TECHNOLOGY AND TRAINING PROGRAM TO TRAIN THIRD WORLD PERSONNEL AND AMERICAN STUDENTS IN THE USE OF MASSACHUSETTS MANUFACTURED MARINE EQUIPMENT.

FINALLY, SERVING AS LINCHPINS TO ALL OF OUR TECHNOLGICAL INITIATIVES WILL BE THE NEW MASSACHUSETTS MICROELECTRONICS CENTER - A $40 MILLION

FACILITY JOINTLY FUNDED BY THE COMMONWEALTH OF MASSACHUSETTS AND PRIVATE INDUSTRY

AND

THE MASSACHUSETTS CORPORATION FOR EDUCATIONAL TELECOMMUNICATIONS. A QUASI PUBLIC AGENCY CHARGED WITH BUILDING AND OPERATING A MULTI-SYSTEM, MULTI-PURPOSE STATEWIDE TELECOMMUNICATIONS NETWORK TO MEET THE EDUCATIONAL AND INFORMATIONAL NEEDS OF BUSINESS AND INDUSTRY, GOVERNMENT AND THE INHABITANTS OF THE COMMONWEALTH.

THE GOAL OF THE CENTERS OF EXCELLENCE IS CLEAR. WE AIM TO FORGE NEW PARTNERSHIPS WITH BUSINESS, EDUCATION AND GOVERNMENT TO CREATE A CLIMATE FOR ACADEMIC RESEARCH, TECHNOLOGICAL INNOVATION AND

ECONOMIC GROWTH SECOND TO NONE IN THE WORLD. WE RECOGNIZE THAT THE CHALLENGE FROM ABROAD IS PARTICULARLY FORMIDABLE. BUT MASSACHUSETTS IS READY TO COMPETE.

AND WE WILL COMPETE IN THE TIME-HONORED TRADITION THAT HAS MADE MASSACHUSETTS SO SUCCESSFUL: WITH A WORKFORCE KNOWN AND RESPECTED FOR ITS ETHIC AND HARD WORK. WITH A POPULATION THAT HAS ALWAYS VALUED EDUCATION. AND WITH AN ENTREPRENEURIAL SPIRIT THAT IS ADVANCING MASSACHUSETTS' LEADERSHIP POSITION IN THE EMERGING KNOWLEDGE-BASED ECONOMY.

I THINK THAT NASA SHARES MANY, IF NOT, ALL OF THESE SAME GOALS.

IT MAKES SENSE FOR US TO WORK TOGETHER.

THANK YOU.

James P. Samuels
First Vice President
Research Department
Shearson Lehman/American Express

BUSINESS OPPORTUNITIES IN SPACE

I would like to begin my presentation with the conclusion.

Nothing breeds success like success, and very simply if the initial, highly visible space based businesses, like Oribital Sciences as an example, are successful -- subsequent endeavors will have far less difficulty raising capital. Two, plans for space ventures must be all inclusive, able to stand on their own merits, must specifically address the objections that most investors will raise, and must be thought out far enough in advance so that potential problems can recognized, addressed early, and overcome. Finally, NASA, the White House, and Congress must be consistent in their support of commercial space ventures and the rules or guidelines cannot be changed in mid stream so as to disadvantage projects already underway.

Now how do we arrive at these conclusions?

Wall Street like everybody else is attempting to discover new and innovative ways of making money. Space because of its conceptual appeal — most people believe that Space in one form or another will play an increasingly important role in their lives — and because of the large dollar amounts involved has piqued the interest of the Wall Street community. Even the most jaded investment banker has paid some attention. To offer some perspective on the size of the market, the Center for Space Policy, an organization specializing in the evaluation of commercial and industrial opportunities in space, has forecast that by the year 2000 — admittedly not right around the corner — but that by the year 2000 gross annual revenues for specific commercial space ventures could approach $65 billion -- not an insignificant sum.

**Table I**

- **Aerospace support** — $3.7 billion in annual revenues and $700 million in tax revenues.

- **Pharmaceutical products** — $27 billion in annual revenues and $5.4 billion tax dollars.

- **Gallium arsenide semiconductor processing** — $3.1 billion in annual revenues, $600 million in tax dollars.

- **Space processed glasses** — $11.5 billion in annual revenues, $2.3 billion in tax dollars.

- **Advanced space communications** — $15 billion in annual revenues, $2.3 billion in tax dollars.

- **Remote sensing** — $2 billion in annual revenues, $400 million in tax dollars.

- **In-orbit servicing** — $2 billion in annual revenues, $400 million in tax dollars.

- **Commercial boosters** — $1 billion in annual revenues, $200 million in tax dollars.

Additionally both the White House, NASA, and also the Congress have been very supportive of space commercialization.

NASA has created a position for commercial programs within NASA's office of space flight, generated a comprehensive space commercialization policy, has begun entering into joint endeavor agreements or JEA's, like the one with Fairchild Industries as an example, to promote private participation in commercial space ventures, and has set aside $50 million in its fiscal 1985 budget for advanced development programs or ADP's.

**Table II**

The Department of Transportation has created the offices of Commercial Space Transportation to help private industry coordinate the many governmental agencies that touch on space activities and to help eliminate at least lessen the bureaucratic tangles and snarls that can exist among different governmental agencies.

The Congress recently passed an act designed to promote economic growth and entrepreneurial activity through the utilization of space and encourages the private sector to provide launch vehicles and associated launch services.

Also Public Law 98-52 provides for a comprehensive civilian program of research and development to enhance the United State's capabilities for remote sensing from space and the application and utilization of such capabilities.

Obviously, some of these examples are related to specific space activities, but the general tone in Washington appears to be very supportive of entrepreneurial efforts in space -- especially in light of the new White House policy that complements the NASA effort by providing tax relief and other incentives to spur investment in commercial space operations.

Unfortunately having projections for huge markets and support from all the important administrative branches of the government is not sufficient, in our opinion, to ensure that adequate capital will be directed toward this industry.

Investors are still going to apply the same set of standards and look for the same elements that must be present in any financial proposal that can attract investors, and this fact creates a major problem with regard to space investments.

For one, space projects are capital intensive; and consequently, most proposals do not have access to venture capitalists whose average project is about $5 million. In space projects $5 million is insignificant. This phenomenon forces entrepreneurs to rely on non-traditional sources of early capital or to structure projects differently. To date most companies have dealt with this obstacle by either being large themselves or by allying themselves with Fortune 500 type companies. McDonnell Douglas teaming with Johnson & Johnson and Orbital Sciences teaming with Martin Marietta are examples of each.

Two, the payback periods are long. Unlike conventional investments, space ventures might not pay off for 8 to 10 years. This compares with the typical 3 to 5 year payback period for typical venture deals. Mathematically, the longer time horizons demand larger positive, future earnings streams once profitability is achieved if a project's internal rate of return is to be competitive.

Three, space projects are perceived to be extremely risky. Interestingly, the list of unknowns for space ventures, though, is not really dissimilar to new, earth based ventures. Will it work? Will it sell? What will it cost to build, and what exogenous factors are likely to adversely affect projections? Nevertheless, industry observers believe that these uncertainties are greater for space related projects than those which they are more accustomed to dealing with.

Four, many of the projects that have been proposed are reliant upon innovative or unproven technologies. This phenomenon sharply heightens the anxiety regarding the will it work question and can we build it within our original cost parameters.

Five, space projects represent an unfamiliar field for many investors. The excitement and conceptional appeal of space notwithstanding, institutional and individual investors require a significant amount of education before they can be comfortable with large investments. With the exception of communications satellites — which have been extremely successful from many perspectives — investors have had little experience with space ventures. As a result, investors are unable to draw upon a store of knowledge to compare these investment opportunities with more traditional ones.

The sum of these observations is that sensible investors will seek extraordinarily high returns as compensation for the real and perceived risk factors which creates a chicken and egg problem. In order to reduce required rates of return, one must enjoy successful ventures. However, to demonstrate this favorable experience, one must have access to capital at affordable or economic rates to begin with.

Aside from these elements, another cause for concern in the investment community is the problem of institutional risk. Earlier we discussed the positive attitudes of the White House, NASA and Congress toward commercial space projects. Unfortunately, the situation is not as clear as the covering verbiage would appear, and many important, fundamental questions have yet to be resolved.

While the White House has voiced its support for commercial space ventures and helped create departmental offices to facilitate space related projects, the administration has also expressed its intentions to lessen governmental regulation, is studying the

possibilities for having governmental agencies turn services, like LANDSAT, over to commercial operations, and has not, to the satisfaction of may potential businessmen, fully clarified NASA's future role or participation in both future and ongoing ventures. In fact NASA itself seems at times to be ambivalent with regard to some of its projects. Also arising is a military/civilian conflict which has yet to be resolved for businesses like Landsat and expendible launch vehicles (ELV) as examples.

Clearly this uncertainty with regard to government support affects risk because the primary proposal for lessening the risks that we have mentioned has been to enlist the aid of the government. By examining some of the aid to date, one can appreciate how government support can be a two edged sword. One of the more obvious forms of help has been subsidized shuttle launch rates. While these rates are presently scheduled to reflect fully allocated costs in 1988, until that transition users of the shuttle service are beneficiaries of a technology which they have enjoyed at a substantial savings. Investment and development tax credits are additional forms of economic aid that can transform otherwise unattractive pro forma statements into financially viable business plans. Joint endeavor agreements or JEA's such as the one between NASA and Fairchild Industries is an example of how private industry and the government can mutually benefit from the joint utilization of common facilities and skills unique to both parties. Finally, and this list is by no means exhaustive, the government can guarantee to purchase a product or service and restrict or bar competitive new entrants in either equipment or service markets.

The benefits in most examples are obvious, although sometimes perceived benefits like tax credits can have the opposite effect of that originally intended if businesses, for example, delay projects while awaiting a yet to be enacted tax

benefit. Another drawback is that price incentives, like reduced shuttle rates could compress launches into a shorter timetable than economic conditions alone would warrant. The primary risk, though, in all the legislatively created benefits and incentives is that they can vanish as quickly as they materialized with just the stroke of a pen; and thus, the economic feasibility of projects that were dependent upon specific government support can be severedly damaged. We believe that this institutional risk is a tremendously important element in space projects.

Therefore, in order to successfully compete in the financial markets for capital, space projects must be structured to overcome most of the objections that investors have identified. We talked earlier about investors requiring high rates of return as compensation for or to offset the multitude of problems that apparently exist. This complaint can be satisfied by simultaneously targeting large markets and restricting competition. Additionally, while many projects require large initial capital investments, subsequent operating expenses tend to be far smaller. Thus, projects can be shown to be immensely profitable after the initial years -- especially if government guarantees continue to restrict competition so that pricing can remain high.

So, by seeking large markets, in this case possibly $65 billion, taking advantage of the operating leverage inherent in such operations, and locking it all in with governmental guarantees and supports, the projections for such an operation can realistically be quite appealing despite all the caveats outlined earlier.

This reality has not gone unnoticed, and, in fact, space has already been big business for many years. In fiscal 1984 the government spent more than $11 billion with outside contractors on space related activity. Moreover, communications satellites

have generated billions of dollars in construction, launch fees, and service revenues. While the bulk of these efforts and expenditures have gone into communications and entertainment satellites, much research and development work is underway in pharmaceuticals, galium arsenide semiconductor processing, space processed gases and metals, and remote sensing to name just a few.

Where has the money for these projects come from?

Aside from tax incentives, free or below cost use of government facilities, and joint efforts with NASA, most space work has been performed by relatively large companies and financed through internally generated funds — something Wall Street has had very little to do with. This phenomenon contrasts with the more conventional sources of capital, namely debt and equity, both of which are somewhat unsuitable for the early stages of space projects.

In order to raise straight equity in the public markets, a space related business would have to demonstrate an internal rate of return of between 50% and 70% which even under the favorable circumstances described earlier might be difficult to do. Debt could possibly be raised at prime plus 3 but some collateral would be necessary that would preclude most service businesses from consideration and limit candidates for debt financing to those involving hard assets like transportation, advanced communications, or perhaps utilities.

These problems then leave only special financing techniques, like R&D partnerships, as possible sources of capital.

An R&D partnership generally contracts with an outside entity to perform research and development for a project. Similarly, some arrangement (normally in the form of an option) is reached with an outside party to provide for the sale of the partnership's technology which provides capital gains treatment of the project's income. These contractual arrangements must be scrutinized to ensure that they do not interfere with partnership deductions and the potential for capital gains treatment of future income.

Because of the complexity of these arrangements and the corresponding requirement for excellent professional assistance in preparing the partnership offering, R&D partnership offerings have high transaction costs compared to most equity and debt offerings. Sales commissions, legal and accounting fees, and printing costs (which are normally not currently deductible for new partnerships) typically account for 10-20% of the offering proceeds. The offerings themselves require six months to a year to structure and complete. R&D partnerships are also expensive in that they by definition involve high risk, for which investors demand a commensurate return. Projected ater-tax internal rates of return for R&D partnerships typically range from 35 to 50 percent — less than sought for in an equity offering but still quite high relative to more traditional investments.

While and R&D partnerships cannot eliminate all the difficulties surrounding commercial space projects, and has some objectionable features of its own, the device has many elements which makes financing unfamiliar ventures more palatable to investors. One of the primary reasons for the popularity of R&D limited partnerships is the tax advantages offered in conjunction with the business goals of

a project. Some of these advantages have been significantly reduced by the Tax Reduction Act of 1984 and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), which seems to contradict the strong support generally provided by Congress and the White House to R&D limited partnerships. Nevertheless, the tax incentives remain sufficiently strong to be attractive. The two important tax advantages are: one, the ability to deduct most of the investment against ordinary income; and two, that future returns can be treated as long-term capital gains.

The deduction of research and development expenses is generally not permitted by an entity that is not yet carrying on a trade or business when these expenses are expected to provide benefits beyond the year in which the expenses are incurred. Normally such expenses are required to be capitalized rather than deducted. However, section 174 of the Internal Revenue Code (IRC) provides an exception to this rule to the effect that a taxpayer may treat research expenditures in connection with his trade or business as deductible expenses in the year in which the outlays are made. What TEFRA changed in 1982 was that a portion of the section 174 deductions became a tax preference items for individuals, and now the advantages of the duduction may be offset to some extent for individuals who are required to pay the alternative minimum tax.

The second tax advantage of R&D limited partnerships is capital gains. In order to provide investors with the possibility of obtaining treatment of their partnership income as long-term capital gain, most partnerships are structured to permit the sale of their capital assets (i.e. the resultant technology) to a third party after the completion of the development period. Certain rigorous tests must be passed in order to make use of this device; and if all key requirements are satisfied, no holding period is necessary to obtain capital gains treatment. The transfer may take

place immediately after the technology is reduced to practice, and, if properly structured, all of the payments in consideration of the transfer receive capital gains treatment regardless of whether the payments are made over time. This treatment is superior to the typical installment sale which carries an interest component (stated or imputed) that is taxed at ordinary income rates.

Moreover, should the resultant technology not be patentable or should the partnership be otherwise unable to effect a section 1235 transfer (i.e. section 1235 of the IRC provides a convenient mechanism for obtaining capital gains treatment for patentable technology) capital gains treatment can still be obtained through section 1221 of the IRC if a sale or exchange of a capital asset can be structured.

Finally, should the partnership not be able to utilize the provisions of section 1235 or 1221, capital gains treatment may still be available under section 1231 of the IRC which states that if the recognized gains on sales or exchanges of property used in the trade or business during the taxable year exceed the recognized losses from such sales or exchanges then such gains and losses shall be considered as gains and losses from the sale or exchange of capital assets held for more than 1 year. In other words, many ways exist to obtain capital gains treatment.

In addition to the tax benefits, the partnership structure itself benefits the individual investor. One, partnerships, unlike corporations, can pass through deductions for R&D expenditures to the individual. Two, participation as a limited partner, rather than as a general partner limits the exposure of the investor to the amount of his investment. Three, the corporation sponsoring the R&D limited partnership is able to retain management control of the project without necessarily diluting its equity or otherwise adversely affecting its balance sheet.

To date the largest space R&D limited partnership that has been completed was Orbital Sciences, and it might be helpful to examine what function Wall Street performed in this offering and discuss why this effort was successful.

The function that Wall Street performed was essentially what it does for all deals which is to establish the distribution network that links interested investors with the people who require the funds. This is the primary function. Additionally bankers provide a host of other services which include financial advice, market timing, and the embellishment of a conceptually appealing business objective, among other financial services.

How was Wall Street able to accomplish this feat, though, in light of all the difficulties which have been mentioned today?

We believe, that Orbital Sciences Corp (OSC) was able to raise money through a limited partnership not solely because a portion of the risks were reduced through tax benefits -- although this feature helps considerably -- but because the entire concept of the organization and its goals seems to be constructed to specifically address the objections that potential investors have raised with regard to space projects.

1. OSC has a reasonable business plan. The plan shows that OSC intends to have a positive cash flow not in the 1990's but in this decade.

2. The principles in the management team while young have had experience in this specific field and have surrounded themselves with older more experienced individuals.

3. The technological risk appears to be low due primarily to the use of "off the shelf" technologies.

4. NASA has agreed that it will not directly fund the development of alternative systems to transfer orbit stage (TOS) missions.

5. OSC has negotiated a fixed price cost incentive contract with Martin Marietta to develop the TOS with a maximum total price or cap so that development costs are not open ended.

6. The number of scheduled launches of geosynchronous satellites shows a dramatic increase in the second half of the decade which should create a strong demand for the TOS missions.

In other words, it is very difficult for a non-technical person or layman to discover a logical flaw in the OSC story -- especially when the end market is as conceptually appealing as space is.

Will this carefully crafted plan ensure the OSC will be successful in meeting its own and investor's objectives? Obviously not. A large part of the success or

failure of OSC and other space ventures will ultimately depend not on the largess of the government but on the underlying economics of the project and partly on the consistency with which governmental policies are administered.

David Thompson, President of OSC, pointed out in a recent speech that a properly conceived and constructed project can be financed by private sources without any government subsidies, loan guarantees, or other forms of direct investment. Perhaps this is true. But can the emerging commercial space industry advance without non-compete agreements from NASA to develop alternative systems — or by eliminating subsidized space shuttle launches while the French continue to subsidize theirs. Can the White House logically promote competitiveness while simultaneously entering into non-competitive agreements.

We do not know how some of these issues and conflicts will be resolved; however, we feel quite strongly that if either the White House or NASA significantly changes the rules in mid stream so that particular projects are disadvantaged or participants become severely handicapped, the commercial space industry will have an extremely difficult time raising capital through traditional mechanisms in the future.

This observation brings us to our last point. Wall Street has been quite clever over the years in developing innovative financing techniques. The problem for new comers, though, was that these creative approaches were usually developed to raise capital for known quantities.

In other words Wall Street is conservative. Bankers, analysts, and portfolio managers, like to see a corporate history, or a track record or, at the very least, something familiar that can be evaluated and or used as a standard.

So, even through the dollar amounts for commercial space projects are sufficiently large to attract the attention of most bankers, the responses or follow through with an actual underwriting has been almost non-existent. Usually a serious reading of the business plan or an educational meeting is all that results.

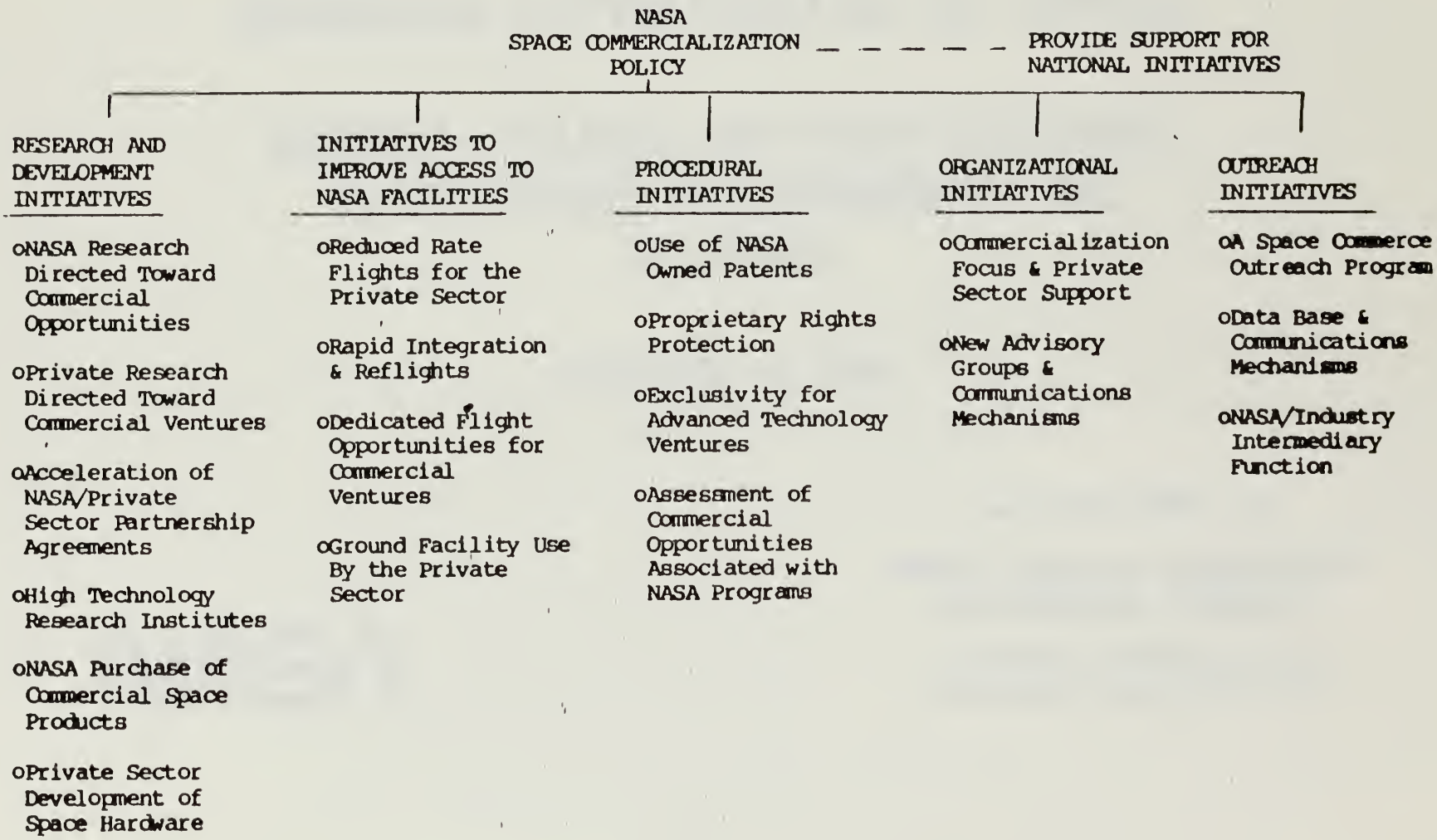
From my perspective while there has been a lot of motion — Wall Street has been more of a fence sitter or observor. There are some exceptions. At Shearson Lehman/American Express we have begun publishing a monthly report jointly with the Center for Space Policy called SPACE which discusses commercial opportunities in this field. The response to this report has been gratifying in that investors appear to be genuinely interested in commercial space ventures. However, most readers simply want to be kept informed about progress in this area and generally remain skeptical about the emergence of real investment opportunities at this time.

At this point in time we believe that Wall Street's job is to educate institutional investors regarding legitimate commercial opportunities in space so that this territory can become familiar ground and to steer investors away from the opportunists attempting to capitalize on the appeal of space.

Finally, Wall Street's participation will to a large degree, in our opinion, be dependent upon the success or failure of early showcase ventures like Orbital Sciences. These first efforts will be watched very closely and if they are successful future efforts to raise capital will be facilitated. If not, raising capital for even non related space ventures could become more difficult.

For those of you in the audience who perceive this presentation to be pessimistic, we do not want to leave you with that impression. We believe, wholeheartedly that many attractive commercial space opportunities presently exist and that additional ones will emerge. However, while we on Wall Street are doing our best to educate the investment community, the entrepreneurs must develop sound business plans that incorporate all facets of a venture far enough in advance so that the majority of the complaints from potential investors can be recognized, addressed, and resolved. Two, unfortunately your ability to raise capital could be like college admissions. While you have control over how well you present yourselves to lenders and investors, you have little control over your predecessors whose success or failure can to some extent determine how you are viewed. Finally, you have a delicate task in your dealings with NASA, the White House and Congress. You will want their support for your projects, and you will not want them to change the rules half way through the game. On the other hand overly restrictive agreements, litigation to preserve guarantees, and selfish adherence to an original plan when changed circumstances would otherwise warrant a different approach will only delay the commercialization of space.

TABLE III


NASA
SPACE COMMERCIALIZATION POLICY
PROVIDE SUPPORT FOR NATIONAL INITIATIVES
RESEARCH AND DEVELOPMENT INITIATIVES
oNASA Research Directed Toward Commercial Opportunities
oPrivate Research Directed Toward Commercial Ventures
oAcceleration of NASA/Private Sector Partnership Agreements
oHigh Technology Research Institutes
oNASA Purchase of Commercial Space Products
oPrivate Sector Development of Space Hardware
INITIATIVES TO IMPROVE ACCESS TO NASA FACILITIES
oReduced Rate Flights for the Private Sector
oRapid Integration & Reflights
oDedicated Flight Opportunities for Commercial Ventures
oGround Facility Use By the Private Sector
PROCEDURAL INITIATIVES
oUse of NASA Owned Patents
oProprietary Rights Protection
oExclusivity for Advanced Technology Ventures
oAssessment of Commercial Opportunities Associated with NASA Programs
ORGANIZATIONAL INITIATIVES
oCommercialization Focus & Private Sector Support
oNew Advisory Groups & Communications Mechanisms
OUTREACH INITIATIVES
oA Space Commerce Outreach Program
oData Base & Communications Mechanisms
oNASA/Industry Intermediary Function

# BUSINESS OPPORTUNITIES IN SPACE:

## NATIONAL POLICIES AND NASA PROGRAMS TO ENCOURAGE THE COMMERCIAL USE OF SPACE

NOVEMBER 16, 1984

L.J. "BUD" EVANS , JR.

DEPUTY ASSISTANT ADMINISTRATOR
FOR COMMERCIAL PROGRAMS

NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

NASA

# COMMERCIAL USE OF SPACE

- BACKGROUND
- OVERVIEW: TWO PARALLEL EFFORTS
  - NATIONAL
  - NASA
- NATIONAL COMMERCIAL SPACE INITIATIVES
  - NATIONAL COMMERCIAL SPACE POLICY
  - CONGRESSIONAL PRONOUNCEMENTS
- NASA COMMERCIALIZATION TASK FORCE
  - PROGRAM INITIATIVES
  - IMPLEMENTATION PLAN
- NASA OFFICE OF COMMERCIAL PROGRAMS

M-84-145
9/24/84

# BACKGROUND

- PRESIDENTIAL LUNCH WITH INDUSTRY LEADERS — AUG 1983
- INDUSTRY COMMERCIAL SPACE GROUP REPORT — DEC 1983
  - "COMMERCIAL ACTIVITIES IN SPACE BY PRIVATE ENTERPRISE NEED TO BEGIN NOW IF OUR NATION IS TO RETAIN ITS LEADERSHIP IN SCIENCE AND TECHNOLOGY . . . AND ITS ADVANTAGES IN INTERNATIONAL TRADE."
  - "WITH GOVERNMENT AS A PARTNER, PRIVATE ENTERPRISE CAN TURN SPACE INTO AN ARENA OF IMMENSE BENEFITS FOR OUR NATION."
- STATE OF THE UNION ADDRESS — JAN 1984
  - "WE WILL SOON IMPLEMENT A NUMBER OF EXECUTIVE INITIATIVES — TO PROMOTE PRIVATE SECTOR INVESTMENT IN SPACE."
- CABINET COUNCIL ON COMMERCE AND TRADE COMMERCIAL SPACE INITIATIVES WORKING GROUP — JUN 1984

M-84-1
7/5/84

# COMMERCIAL SPACE CONGRESSIONAL ACTIONS

- "THE CONGRESS DECLARES THAT THE GENERAL WELFARE OF THE UNITED STATES REQUIRES THAT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SEEK AND ENCOURAGE, TO THE MAXIMUM EXTENT POSSIBLE, THE FULLEST COMMERCIAL USE OF SPACE"

  **PUBLIC LAW 98–361**

- "...THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE AND THE SENATE COMMERCE, SCIENCE, AND TRANSPORTATION COMMITTEE URGE NASA TO MOVE EXPEDITIOUSLY IN ESTABLISHING A HIGH LEVEL FOCAL POINT TO FACILITATE SPACE COMMERCIALIZATION AND DIRECT THAT NASA PROPOSE A NEW LINE ITEM FOR THIS ACTIVITY IN FISCAL YEAR 1986 BUDGET REQUEST."

  **FY 1985 HOUSE AND SENATE CONFERENCE REPORT**

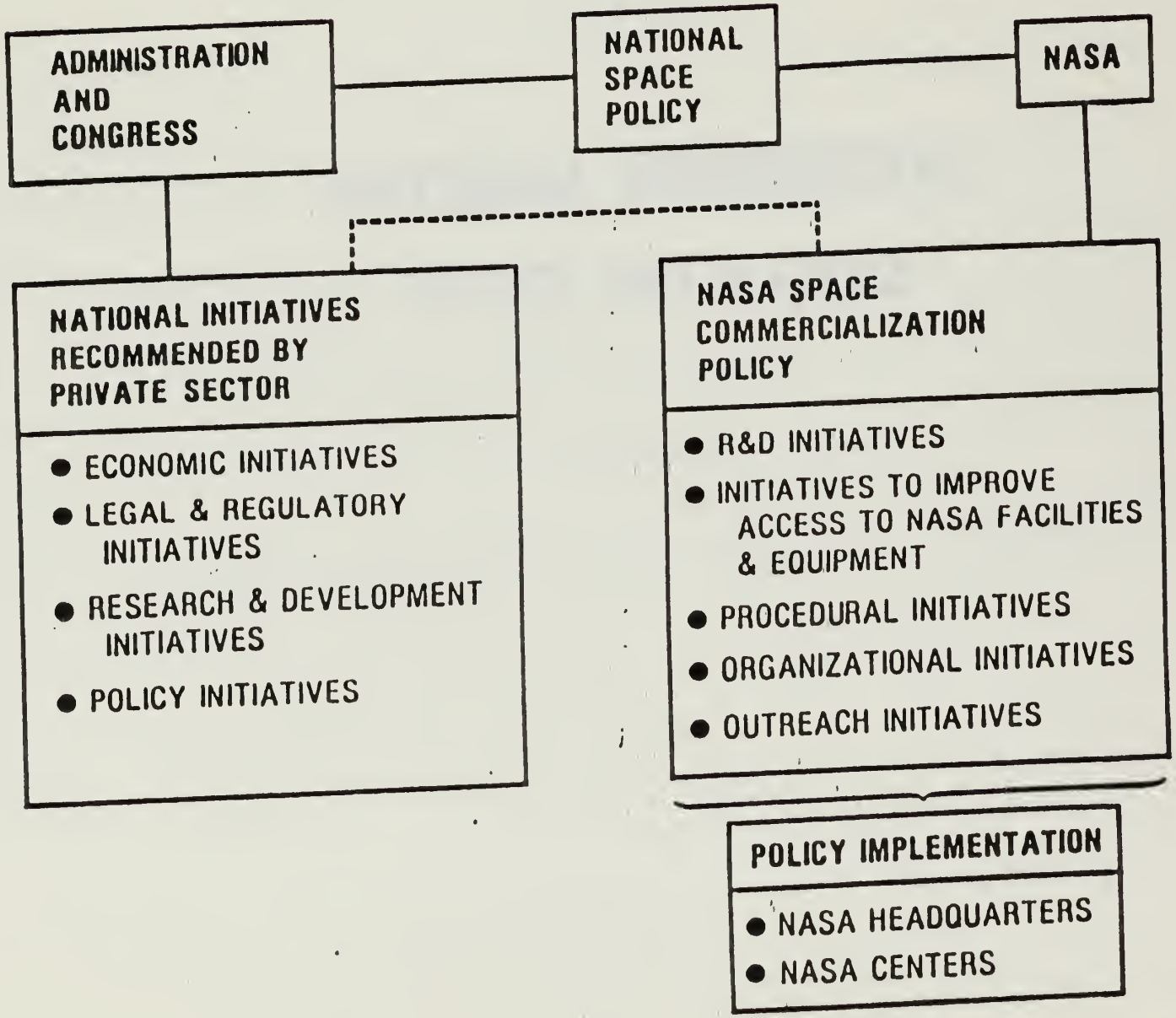
- H.R. 5975 "TAX STATUS OF SPACE ACT"

  **INTRODUCED BY CONGRESSMAN BATEMAN, JUNE 29, 1984**

- S. 3010, "TO PROVIDE THAT CERTAIN ACTIVITIES PERFORMED IN SPACE AND CERTAIN ARTICLES PRODUCED IN SPACE SHALL BE TREATED AS ACTIVITIES PERFORMED AND ARTICLES PRODUCED WITHIN THE UNITED STATES FOR PURPOSES OF ANY TAX OR CUSTOMS LAW OF THE UNITED STATES

  **INTRODUCED BY SENATOR GORTON, SEPTEMBER 21, 1984**

# SPACE COMMERCIALIZATION

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9/28/84

# NATIONAL COMMERCIAL SPACE INITIATIVES

# COMMERCIAL SPACE INITIATIVES OVERVIEW

- **EXECUTIVE INITIATIVES PROPOSED IN FOUR MAJOR AREAS**
  - ECONOMIC INITIATIVES
  - LEGAL AND REGULATORY INITIATIVES
  - RESEARCH AND DEVELOPMENT INITIATIVES
  - INITIATIVES TO ESTABLISH AND IMPLEMENT A COMMERCIAL SPACE POLICY

# NATIONAL COMMERCIAL SPACE INITIATIVES

## ECONOMIC

- MODIFY "CARRYING-ON" TEST FOR THE 25% RESEARCH TAX CREDIT AND TREAT R&D PERFORMED IN SPACE THE SAME AS R&D PERFORMED IN THE U.S. (I–1)
- MODIFY THE TAX CODE TO ASSURE THAT SPACE CAPITAL PROJECTS ARE NOT EXCLUDED FROM THE 10% INVESTMENT TAX CREDIT AND THE ACCELERATED COST RECOVERY SYSTEM (I–2)
- FACILITATE CONTRACTS WITH NEW SPACE VENTURES IF THE GOVERNMENT HAS A NEED FOR THE PRODUCT AND IF THE PURCHASE WOULD BE COST-EFFICIENT (I–3)
- PERMIT EXPENSE DEDUCTIONS FOR PROTOTYPE SPACECRAFT (I–4)
- MODIFY TAX REGULATIONS TO ASSURE SPACE-MADE PRODUCTS ARE NOT CONSIDERED IMPORTS WHEN RETURNED TO THE U.S. (I–5)

## LEGAL AND REGULATORY

- ASSURE THAT RADIO FREQUENCY ASSIGNMENT FOR PRIVATE SECTOR USE IS TIMELY (II–1)
- REPLACE THE MUNITIONS CONTROL ACT AND ITAR FOR PRIVATE SPACE LAUNCH REGULATION (II–2)
- PROVIDE ADDITIONAL PROTECTION OF PROPRIETARY INFORMATION (II–1)
- ASSURE FAIR INTERNATIONAL COMPETITION (II–4)

# NATIONAL COMMERCIAL SPACE INITIATIVES (CONTINUED)

## RESEARCH AND DEVELOPMENT

- ENCOURAGE GREATER INDUSTRY PARTICIPATION IN SPACE RESEARCH AND DEVELOPMENT PROGRAMS AND BROADEN NON-AEROSPACE INDUSTRY AWARENESS OF COMMERCIAL SPACE OPPORTUNITIES. (III—1)

## POLICY

- ESTABLISH AND IMPLEMENT A CONSISTENT COMMERCIAL SPACE POLICY. (IV—1)
- DEVELOP A PLAN FOR PRIVATIZATION OF SPECIFIC GOVERNMENT SPACE ACTIVITIES. (IV—3)
- ESTABLISH A HIGH-LEVEL NATIONAL FOCUS FOR COMMERCIAL SPACE ISSUES. (IV—4)

# INITIATIVES REQUIRING ADDITIONAL STUDY

## ECONOMIC

- MODIFY 25% TAX CREDIT FOR SPACE INDUSTRIES WHERE THEIR UNIQUE CHARACTERISTICS MAY WARRANT DISTINCT PROVISIONS. (I—2)

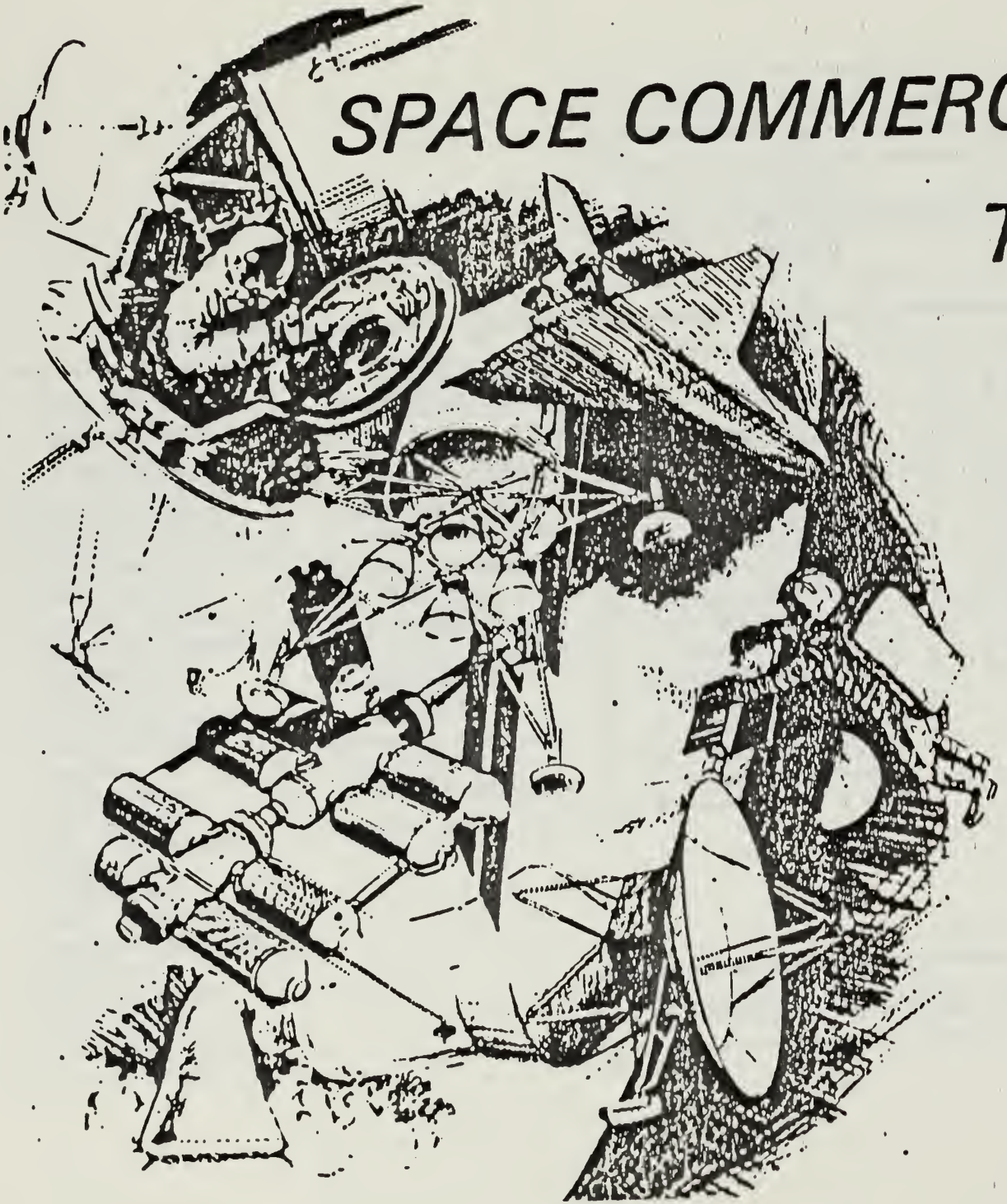
- ASSURE THAT FREE GOVERNMENT SERVICES FOR RESEARCH AND DEVELOPMENT ARE NOT TAXED. (I—6)

## POLICY

- ASSURE REASONABLY PRICED ACCESS TO THE SHUTTLE. (IV—2)

DRAFT

# SPACE COMMERCIALIZATION TASK FORCE



NASA

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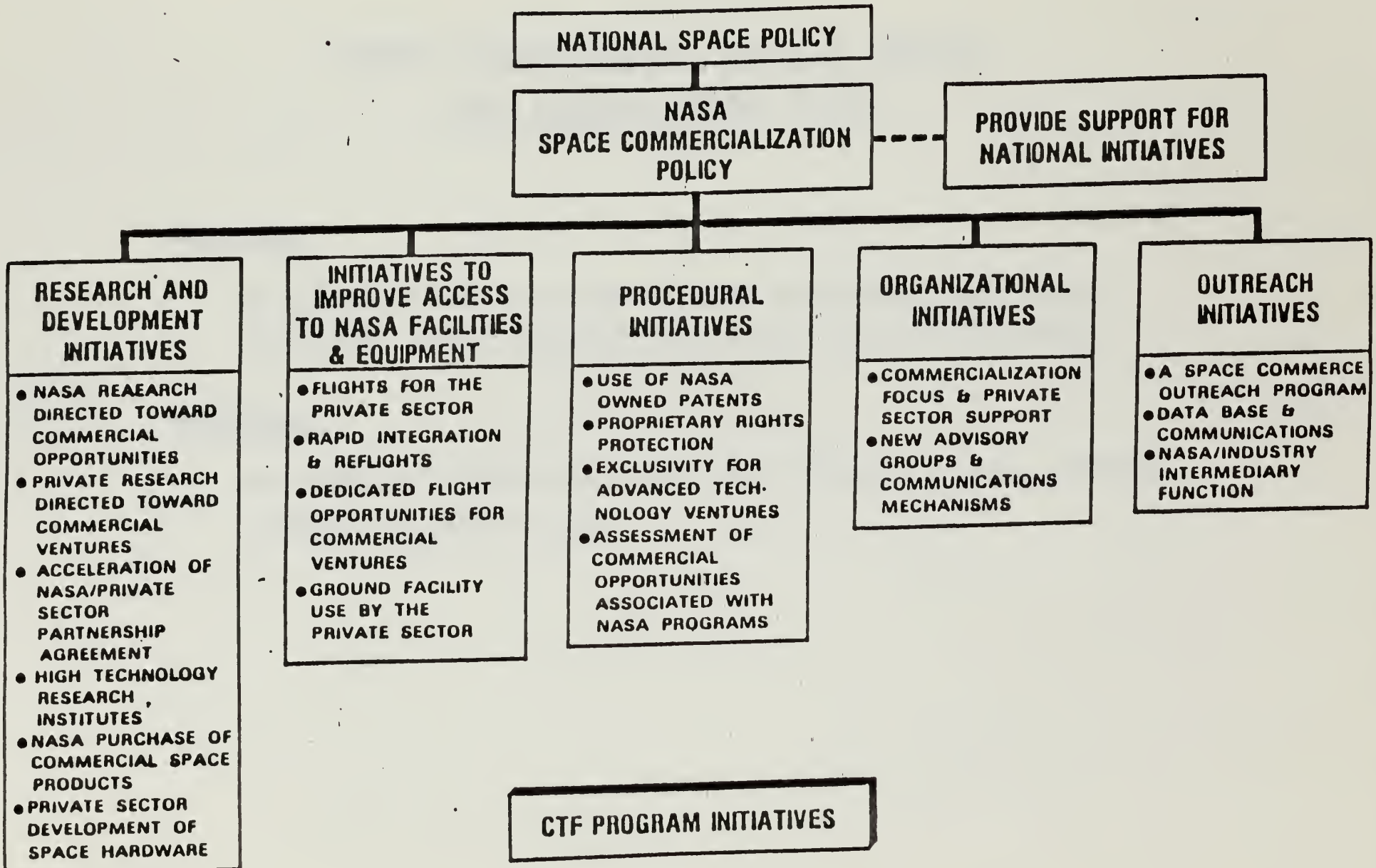


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DRAFT

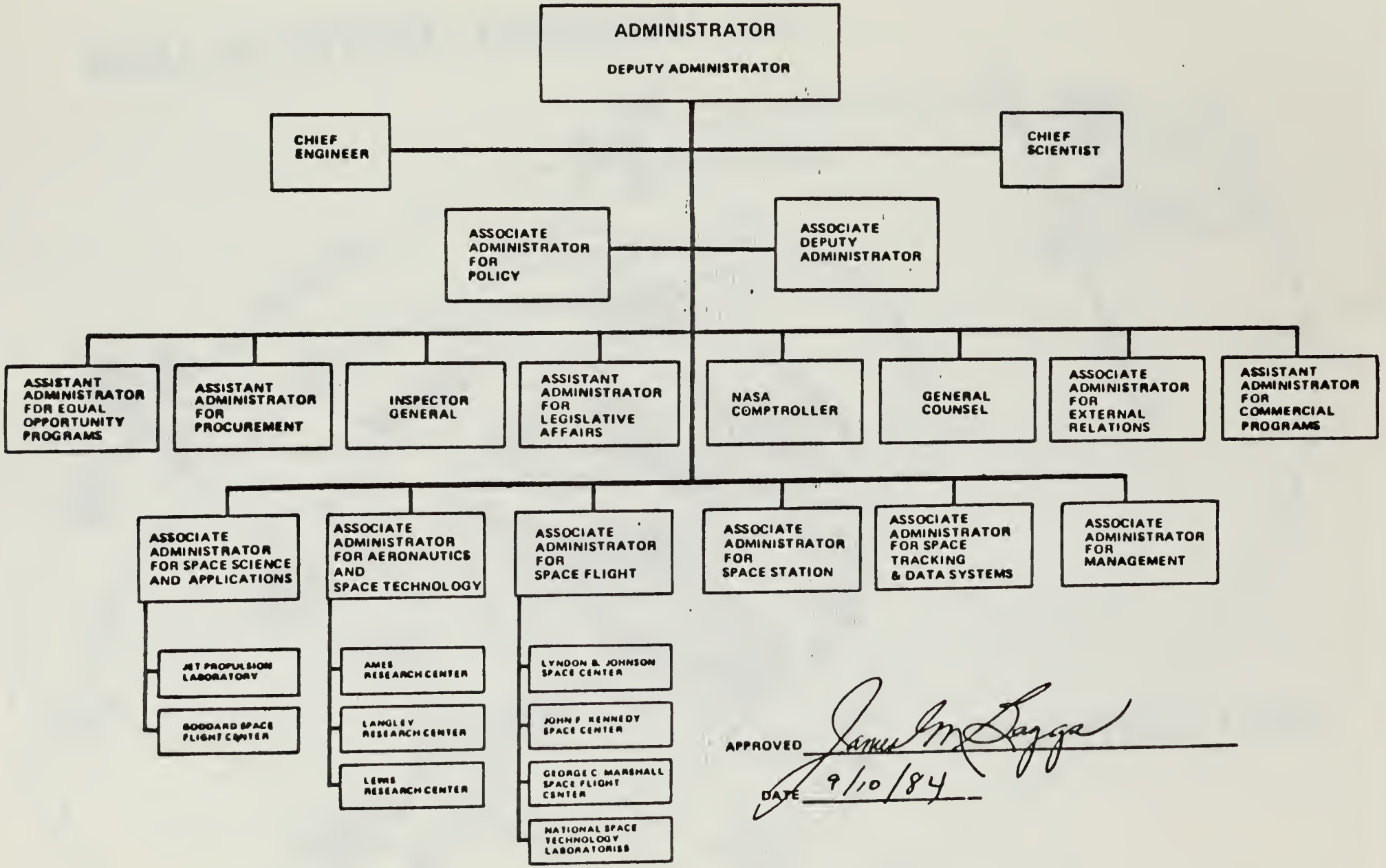
# NASA COMMERCIAL SPACE POLICY IMPLEMENTATION PLAN

**PURPOSE:**

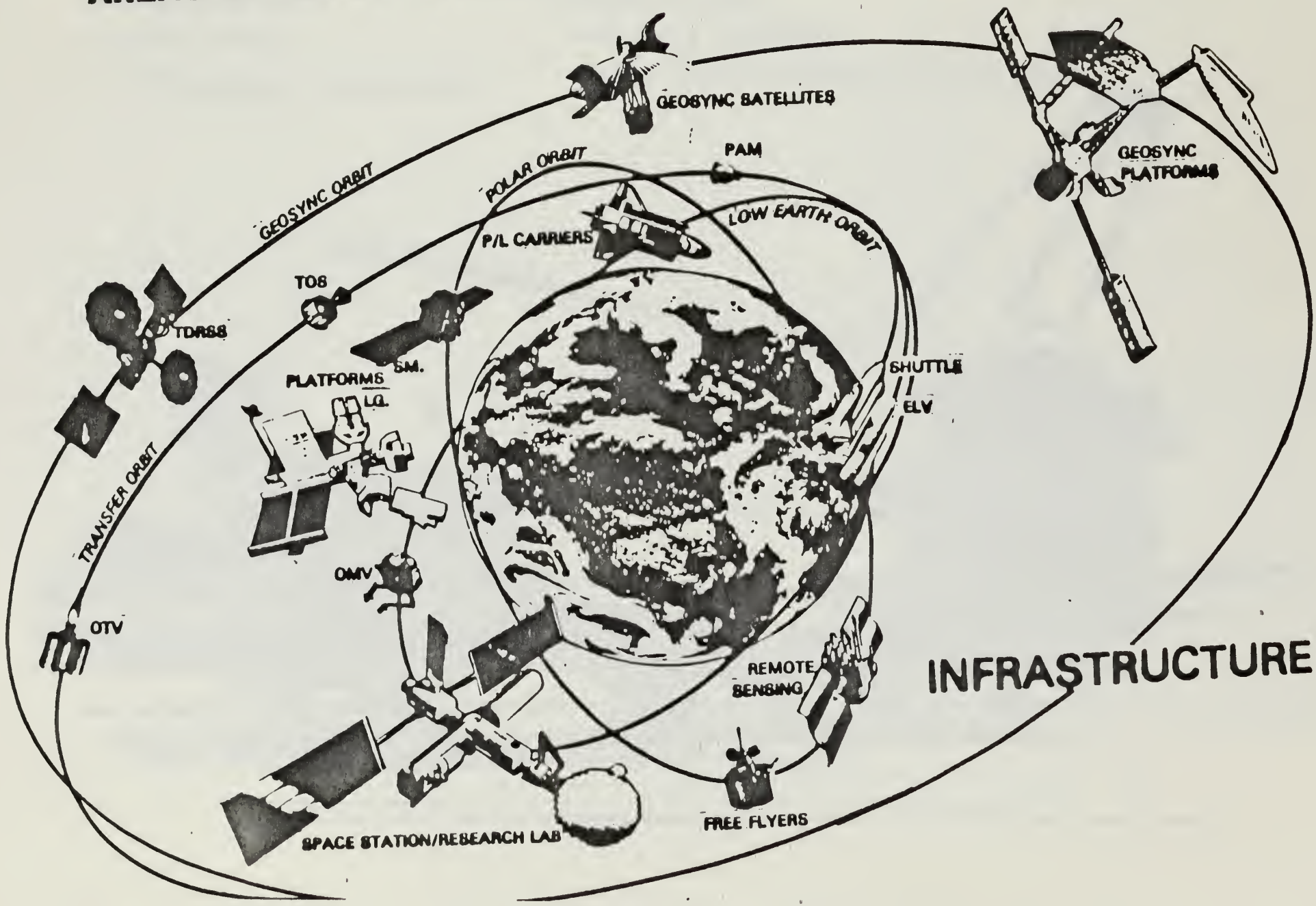
TO DEFINE INTERNAL NASA ACTIONS WHICH WILL IMPLEMENT THE NASA SPACE COMMERCIALIZATION POLICY INITIATIVES

**OBJECTIVE:**

TO TRANSLATE POLICY INTO ACTIONS THROUGH A WELL DEFINED AGENCY PROGRAM PLAN

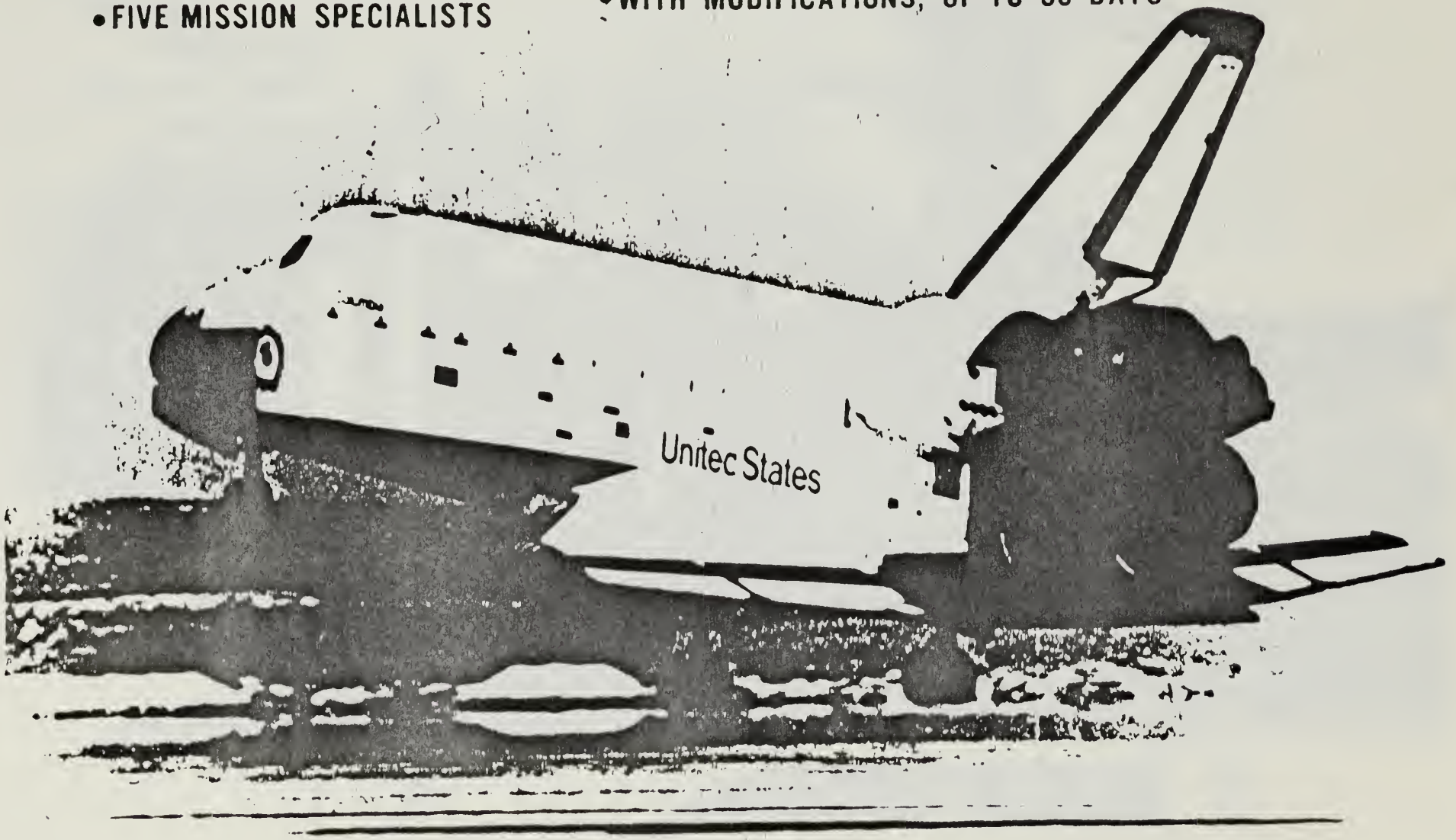

ADMINISTRATOR
DEPUTY ADMINISTRATOR
CHIEF ENGINEER
CHIEF SCIENTIST
ASSOCIATE ADMINISTRATOR FOR POLICY
ASSOCIATE DEPUTY ADMINISTRATOR
ASSISTANT ADMINISTRATOR FOR EQUAL OPPORTUNITY PROGRAMS
ASSISTANT ADMINISTRATOR FOR PROCUREMENT
INSPECTOR GENERAL
ASSISTANT ADMINISTRATOR FOR LEGISLATIVE AFFAIRS
NASA COMPTROLLER
GENERAL COUNSEL
ASSOCIATE ADMINISTRATOR FOR EXTERNAL RELATIONS
ASSISTANT ADMINISTRATOR FOR COMMERCIAL PROGRAMS
ASSOCIATE ADMINISTRATOR FOR SPACE SCIENCE AND APPLICATIONS
ASSOCIATE ADMINISTRATOR FOR AERONAUTICS AND SPACE TECHNOLOGY
ASSOCIATE ADMINISTRATOR FOR SPACE FLIGHT
ASSOCIATE ADMINISTRATOR FOR SPACE STATION
ASSOCIATE ADMINISTRATOR FOR SPACE TRACKING & DATA SYSTEMS
ASSOCIATE ADMINISTRATOR FOR MANAGEMENT
JET PROPULSION LABORATORY
GODDARD SPACE FLIGHT CENTER
AMES RESEARCH CENTER
LANGLEY RESEARCH CENTER
LEWIS RESEARCH CENTER
LYNDON B. JOHNSON SPACE CENTER
JOHN F. KENNEDY SPACE CENTER
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL SPACE TECHNOLOGY LABORATORIES
APPROVED James M Beggs
DATE 9/10/84

# AREAS OF POTENTIAL COMMERCIAL USE



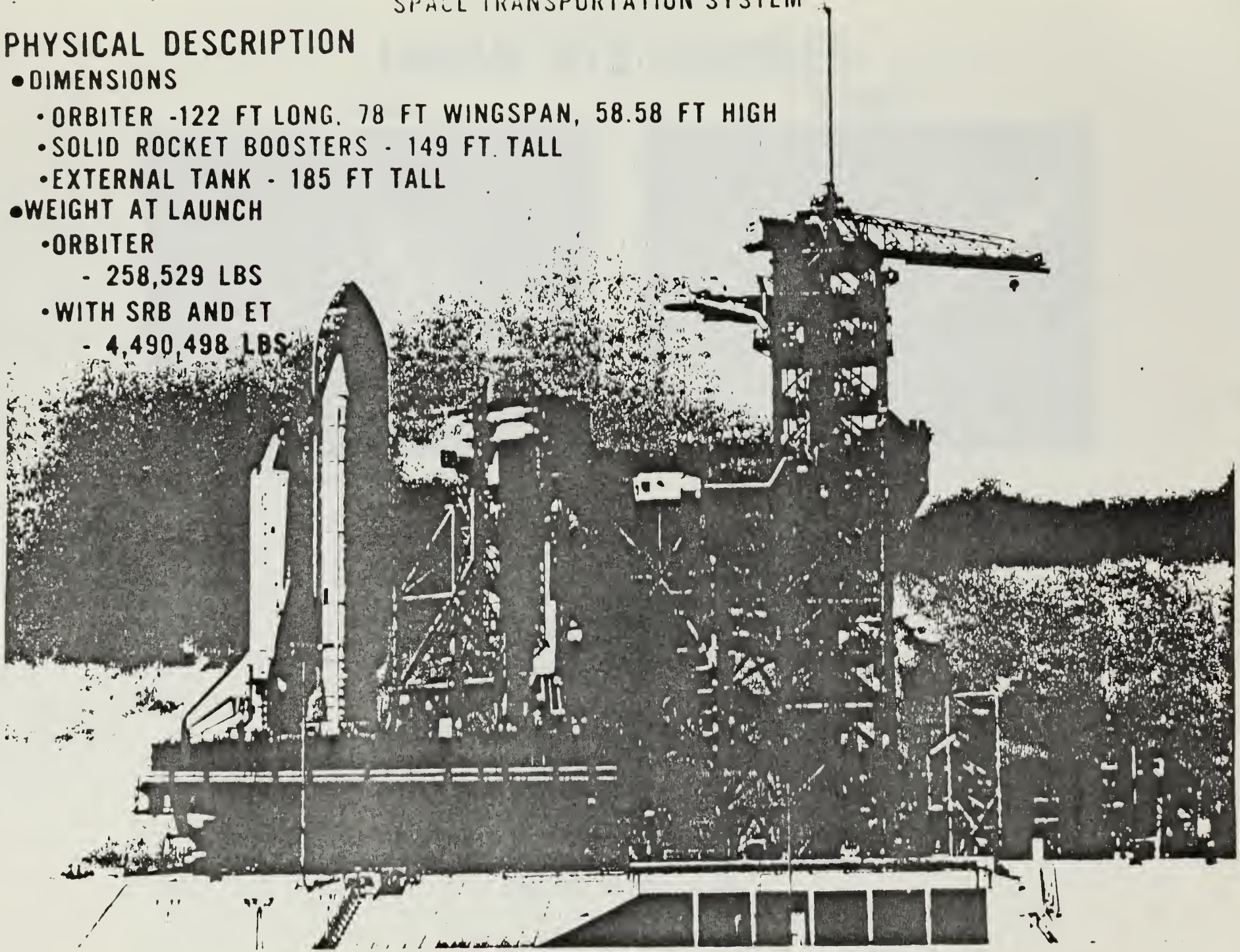
## PHYSICAL DESCRIPTION

- CREW CAPACITY
  - TWO PILOTS
  - FIVE MISSION SPECIALISTS
- MISSION LENGTH
  - 10 DAYS MAXIMUM
  - WITH MODIFICATIONS, UP TO 30 DAYS



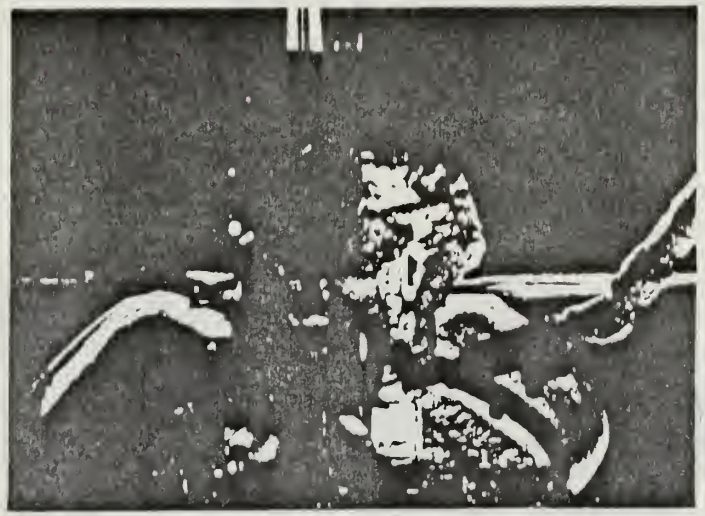
# PHYSICAL DESCRIPTION

- DIMENSIONS
  - ORBITER -122 FT LONG. 78 FT WINGSPAN, 58.58 FT HIGH
  - SOLID ROCKET BOOSTERS - 149 FT. TALL
  - EXTERNAL TANK - 185 FT TALL
- WEIGHT AT LAUNCH
  - ORBITER
    - 258,529 LBS
  - WITH SRB AND ET
    - 4,490,498 LBS



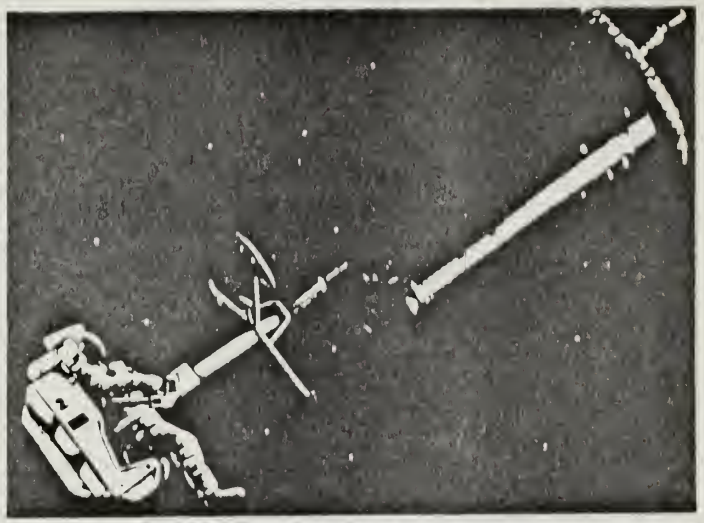
# UNIQUE STS SERVICES

REPAIR



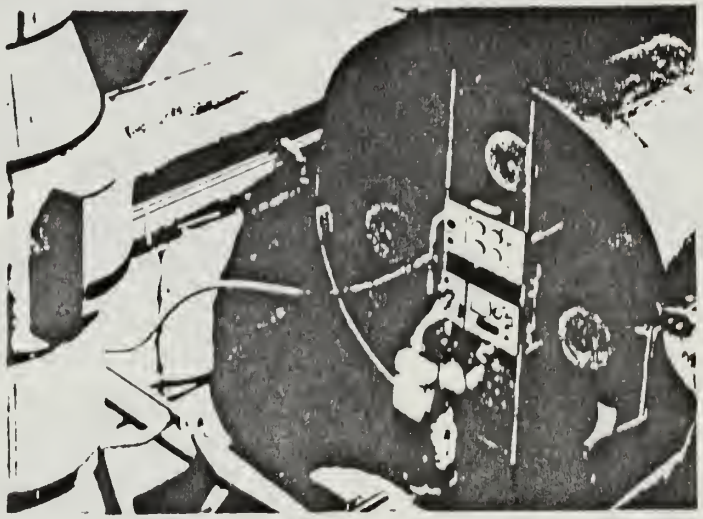
STS–41C APRIL 6,1984

RETRIEVAL



STS–51A NOVEMBER ,1984

REFUELING



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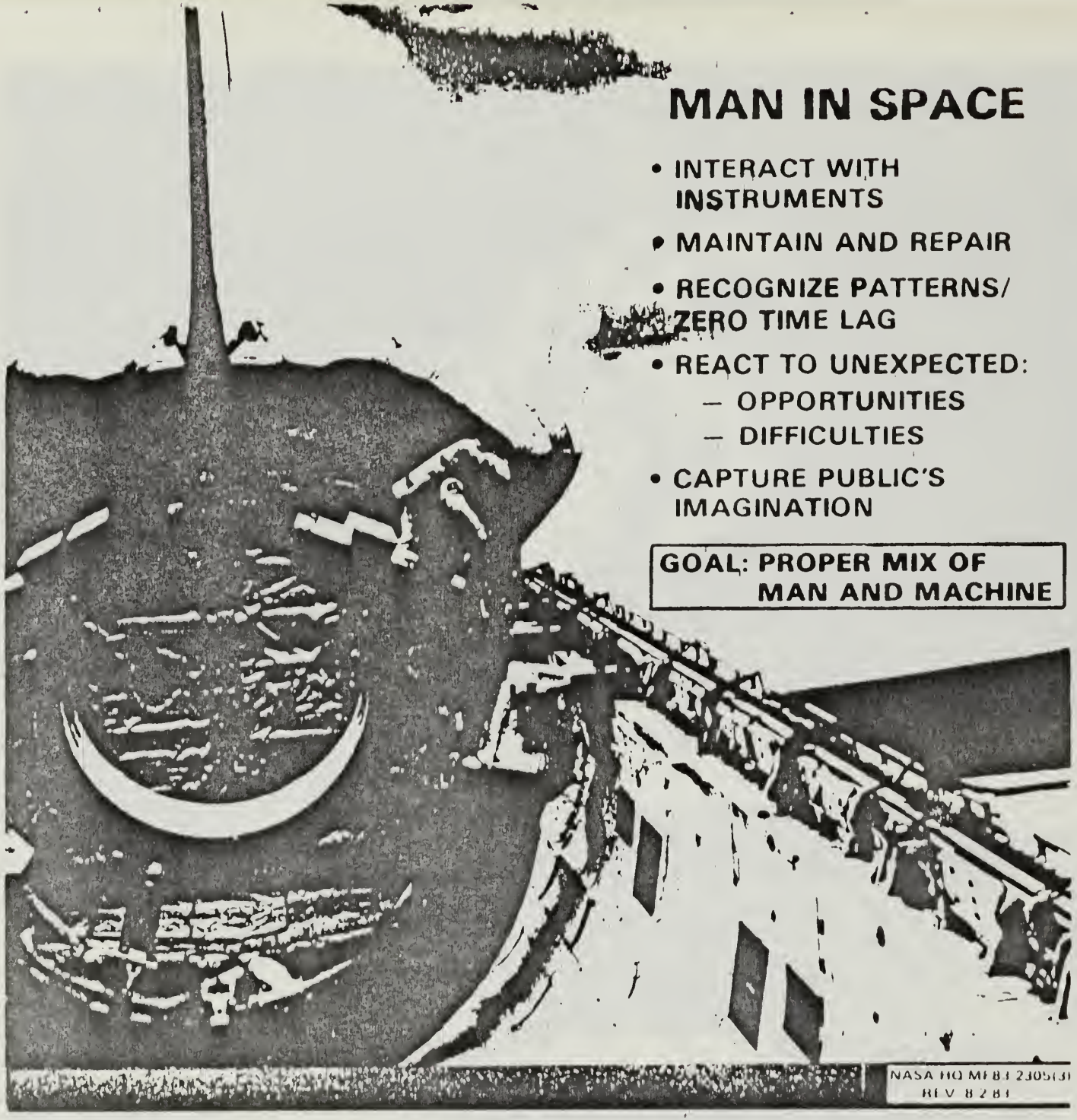

# MAN IN SPACE

- INTERACT WITH INSTRUMENTS
- MAINTAIN AND REPAIR
- RECOGNIZE PATTERNS/ ZERO TIME LAG
- REACT TO UNEXPECTED:
  - OPPORTUNITIES
  - DIFFICULTIES
- CAPTURE PUBLIC'S IMAGINATION

**GOAL: PROPER MIX OF MAN AND MACHINE**

NASA HQ MF81 230513
REV 8281

# NASA CAPABILITIES FOR MICROGRAVITY RESEARCH

CAPABILITIES INCLUDE:

- GROUND-BASED FACILITIES
- SPACE-BASED FACILITIES

# NASA GROUND-BASED FACILITIES (NONORBITAL)

| FACILITY | LOCATION | DURATION OF EXPOSURE TO NEAR ZERO-G |
|---|---|---|
| DROP TOWERS | MARSHALL SPACE FLIGHT CENTER, AL<br>LEWIS RESEARCH CENTER, OH | 2-5 SEC. |
| DROP TUBES | MARSHALL SPACE FLIGHT CENTER, AL | 5 SEC. |
| AIRCRAFT<br>• KC-135<br>• F-104 | JOHNSON SPACE CENTER, TX<br>DRYDEN RESEARCH CENTER, CA | 20-25 SEC.<br>60 SEC.<br>(REPEATED SEVERAL TIMES PER FLIGHT) |
| SOUNDING ROCKETS | WHITE SANDS, NM | 5 MIN. |

- COST FOR USE OF FACILITY MAY RANGE FROM NO COST UNDER JOINT ENDEAVOR AGREEMENT TO REIMBURSEMENT FOR SHARE OF COST. EXPERIMENT PACKAGE SUPPLIED BY EXPERIMENTER.

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# SPACE-BASED FACILITIES (ORBITAL)

| PROGRAM | STATUS | CONTACT | COMMENTS | DURATION OF EXPOSURE TO NEAR ZERO-G |
|---|---|---|---|---|
| SMALL SELF-CONTAINED EXPERIMENTS | ACTIVE | DONNA MILLER<br>NASA HEADQUARTERS<br>WASHINGTON, DC | SEVERAL EXPERIMENTS HAVE FLOWN. POLICY IN PLACE. | 10 DAYS |
| CAPACITY FOR OPPORTUNITY PAYLOAD EXPERIMENTS<br>• MULTI-POSITIONARY EXPERIMENT SUPPORT STRUCTURE (MPESS)<br>• COMMERCIAL SYSTEMS | PLANNING | JOHN MOYE<br>ROBERT LOHMAN<br>NASA HEADQUARTERS<br>WASHINGTON, DC | CONCEPT IS IN DISCUSSION<br>POLICY FOR ACCESSING DOES NOT EXIST. | 10 DAYS |
| SPACELAB<br>• PALLETS<br>• HABITABLE MODULES | ACTIVE | MICHAEL SANDER<br>NASA HEADQUARTERS<br>WASHINGTON, DC | FIRST FLIGHT STS-9<br>POLICY FOR COMMERCIAL USE NOT YET APPROVED | 10 DAYS |
| CREW COMPARTMENT AREAS (SHUTTLE) | ACTIVE | RONALD PHILIPS<br>NASA HEADQUARTERS<br>WASHINGTON, DC | MID-DECK USED BY MDAC/J&J.<br>POLICY FOR COMMERCIAL USE NOT ESTABLISHED. | 10 DAYS |
| PAYLOAD BAY (15 FT. DIA. X 60 FT. LONG) (SHUTTLE) | ACTIVE | CHESTER LEE<br>CUSTOMER SERVICES<br>NASA HEADQUARTERS<br>WASHINGTON, DC | ESTABLISHED POLICY FOR COMMERCIAL USE. MINIMUM BUY IS ¼ OF PAYLOAD BAY. | 10 DAYS |
| SHUTTLE LAUNCHED SPACECRAFT (UP TO 65,000 LBS.) | ACTIVE | CHESTER LEE<br>CUSTOMER SERVICES<br>NASA HEADQUARTERS<br>WASHINGTON, DC | LAUNCH CAPABILITY DEMONSTRATED. REVISIT CAPABILITY TO BE DEMONSTRATED IN STS-13 | 6 TO 9 MONTHS |

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# JOINT VENTURE POSSIBILITIES

- TECHNICAL EXCHANGE AGREEMENTS (TEA'S)
  - — EXCHANGE TECHNICAL INFORMATION AND COOPERATE IN CONDUCT AND ANALYSIS OF GROUND-BASED RESEARCH
- INDUSTRIAL GUEST INVESTIGATOR (IGI'S)
  - — CORPORATE SCIENTIST COLLABORATES (AT COMPANY EXPENSE) WITH NASA P.I. ON SPACE FLIGHT EXPERIMENT
- JOINT ENDEAVOR AGREEMENTS (JEA'S)
  - — AGREEMENT HAVING COMMERCIAL PRODUCT/PROCESS/SERVICE AS END OBJECTIVE (EXCLUSIVITY, PATENT AND DATA RIGHTS, LAUNCH SERVICES COSTS ARE NEGOTIABLE)

NASA DOES WHAT IT DOES BEST,
INDUSTRY OPERATES IN OWN AREAS OF EXPERTISE

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453-8435

# GUIDING PRINCIPALS

- TECHNICAL IDEA
- PARTNERSHIPS
- NO EXCHANGE OF FUNDS
  - PRIVATE INVESTMENT TO PRECEDE ANY NASA INVESTMENT OF RESOURCES
- QUID-PRO-QUO
- EXCLUSIVITY, PATENT AND DATA RIGHTS NEGOTIABLE

NASA-MC-8

Chart 1 of 2

# [illegible] IN PARTNERSHIP WITH NASA

| | OBJECTIVE | AGREEMENT WITH NASA | STATUS |
|---|---|---|---|
| [illegible] PHARMACEUTICALS | [illegible] PRODUCTION OF PHARMACEUTICALS IN SPACE | JEA SIGNED 1/80 | 4 SUCCESSFUL FLIGHTS |
| [illegible] RESEARCH RD RANDOLPH 5288 | PRODUCTION OF GAAS IN SPACE | JEA SIGNED 4/83 | 1st FLIGHT IN 85/86 |
| [illegible] INDUSTRIES INC [illegible] | UNMANNED SPACE PLATFORM FOR LEASE | JEA SIGNED 8/83 | 1st FLIGHT IN 87 |
| [illegible] | STS BAY ENVIRON MENTAL MONITORING INSTRUMENT [illegible] | JEA SIGNED 1/84 | 1st FLIGHT IN 85 |
| [illegible] CORP [illegible] | TRANSFER ORBIT STAGE | COOPERATIVE (JEA) SIGNED 4/83 | 1st FLIGHT IN 86 |
| [illegible] | RESEARCH ON GRAPHITE [illegible] (LWG) | TEA EXTENDED | JEA POSSIBLE |
| [illegible] | [illegible] CATALYTIC [illegible] | TEA SIGNED 8/81 | RESEARCH COMPLETE |
| [illegible] MENT [illegible] (ANDING | | | STANLEY R. SCHNEIDER CHIEF, STUDIES AND ECONOMIC ANALYSIS BRANCH 453-8435 |

# [illegible]USTRY SPACE-RELATED ACTIVITIES IN PARTNERSHIP WITH NASA

| CORPORATION | COMMERCIAL OBJECTIVE | AGREEMENT WITH NASA | STATUS |
|---|---|---|---|
| [illegible]O<br>[illegible]SCHULTZ<br>([illegible]) 5[illegible]200 | RESEARCH ON ELECTROPLATING (Low G) | TEA SIGNED 8/81 | IN PROGRESS |
| HONEYWELL<br>ROBERT A. LANCASTER<br>(6[illegible]7 862-8222 | RESEARCH ON $HgO_D$ TELLURIDE CRYSTAL GROWTH (LowG) | TEA SIGNED 2/83 | IN PROGRESS |
| A[illegible] LITTLE<br>PETER D. LASER<br>(617) 864-5770 | RESEARCH ON LONG TERM BLOOD STORAGE (Low G) | MOU SIGNED 2/83 | INDUSTRY CONSORTIUM BEING FORMED |
| C[illegible]/ACELINES<br>K[illegible]ARD PEDOLSKY<br>C[illegible] 731-5650 | STS CARGO BOOKING SERVICE | MOU SIGNED 1/84 | |
| J[illegible]DRF<br>C[illegible]S PODSTADLY<br>([illegible]) 730-7229 | RESEARCH ON IMIN FILMS, ORGANIC CRYSTALS (Low G) | MOU SIGNED 1/84 | TEA IN DRAFT |
| SP[illegible]E INDUSTRIES, Inc.<br>MA[illegible] FAGET<br>(71[illegible] | INDUSTRIAL SPACE FACILITY | MOU SIGNED 2/84 | IN PROGRESS |
| GE[illegible]MICS<br>W[illegible]ECTOR<br>(71[illegible]) | COMMERCIAL ATLAS/CENTAUR | CONTRACTUAL AGREEMENT | IN NEGOTIATION |
| TR[illegible]BARRIERS<br>DA[illegible]GRUNER<br>12[illegible] | COMMERCIAL DELTA | CONTRACTUAL AGREEMENT | SUBMITTED FOR CONGR REVIEW |

JE[illegible]JOINT ENDEAVOR AGREEMENT
TEA = TECHNICAL EXCHANGE AGREEMENT
MOU = MEMORANDUM OF UNDERSTANDING

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# INDUSTRY INTEREST IN SPACE

- HIGHER NOW THAN IN THE PAST
- EXPERIMENTATION NOT PRODUCTS
  - UNDERSTANDING UNIQUE PROPERTIES OF SPACE
  - INVESTIGATING PROCESS BEHAVIOR TO IMPROVE EARTH-BASED MANUFACTURING
- SPACE SERVICES SUPPORT
  - ON-ORBIT RESEARCH FACILITIES AND SERVICES
  - LAUNCH SERVICES
  - GROUND SUPPORT SERVICES